WORLD'S POULTRY SCIENCE JOURNAL

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WORLD'S POULTRY SCIENCE JOURNAL

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BROILER PRODUCTION ON REGULARLY CHANGED BEDDING VERSUS DEEP LITTER AND WIRE FLOOR

A. K. HALAMA,

Beratungsbureau fuer Fuetterung und Futtertechnik, Vienna, Austria

The following investigations were undertaken as a contribution to the problem whether the different forms of management indicated in the title influenced growth, feed conversion and losses of male chicken (New Hampshire × White Leghorn crosses) from hatching to an age of nine weeks. The individual quarters measured about 3.3 sq. meters (about 37 sq. ft.) and housed 50 birds; that corresponds to a population density of roughly 15 birds per sq. meter (1.35 per sq. ft.).

The regularly changed bedding consisted of a 4″ layer of chopped wheat straw renewed at weekly intervals. After finishing each batch of broilers cleaning and disinfection took place. The deep litter was formed by a 6″ layer of equal parts of peat moss and chopped wheat straw; the surface was loosened every time it showed signs of beginning to cake. At the end of each production series this bedding was heaped for 4 days to promote self-heating (with the intention to reduce the number of coccidia oocyts and helminth larvae resp.ova as shown by Horton-Smith and Long, 1954). Then the material was spread again and supplemented with some burnt limestone and, if necessary, a certain limited amount of fresh straw choppings. After a period of rest of about three days and thorough mixing the next batch of hatching chicken were put onto this litter. When the third production series was terminated, no further additions were made and also heaping the litter was discontinued. It was stirred and loosened only about once a week. The third form of management comprised pens of the same size whose floor consisted of the strong wire meshwork usually found in broiler batteries. Below this floor easily accessible drawers of hardboard were installed and regularly dusted with superphosphate to inhibit ammonium release. Droppings were removed every third day. After moving out each production series thorough cleaning and disinfection was undertaken.

A chicken starter of a 20% protein all-mash type was fed until the fourth week, followed by a broiler finisher with similar protein but higher calorie values. Both rations contained a medium supply of animal proteins and were fortified with minerals, vitamins, trace elements and antibiotics. They were offered ad lib. in all three groups in similar metal-sheet troughs separated from the animals by a spacy rail to prevent contamination and wastage. A continuous stream of drinking water was provided in a metal gutter protected in similar way.

RESULTS

The mean hatching weight of all batches was very near 40 grams. The following table 1 gives the average nine week weights of each of the consecutive batches of 50 starting birds.

TABLE I

Average nine week weight of broilers on different bedding (grams)

Production series	Changed litter	Deep litter	Wire floor
1st	958.5	954.1	1029.8
2nd	937.1	930.6	965.1
3rd	930.1	939.4	950.3
4th	948.2	959.6	962.0
5th	951.3	978.4	978.1
6th	941.1	995.6	989.2
7th	950.8	1063.4	971.1
8th	928.6	990.8	953.1
mean	943.2	974.1	974.5

The second, third and eighth production series were performed in cold weather and the heating implement was able to raise the room temperature only up to nearly 12°C (as measured 1 ft. above ground). This may also account for the somewhat depressed final weights. The total losses amounted to: regularly changed litter 7.2, deep litter 4.8, and wire floor 4.9%. Includings the losses (and the little occurring waste of feed) the following amounts of ration were necessary to produce one unit of living weight (table 2):

TABLE 2

Average feed conversion rates of broilers on different bedding (units of ration per unit of weight gain)

Production series	Changed litter	Deep litter	Wire floor
1st	3.12	3.20	3.05
2nd	3.42	3.39	3.56
3rd	3.40	3.48	3.55
4th	3.42	3.25	3.40
5th	3.45	3.00	3.51
6th	3.32	2.95	3.12
7th	3.35	2.81	3.16
8th	3.48	2.90	3.19
mean	3.37	3.12	3.32

DISCUSSION

Final weights of all birds are not outstanding but crossings of White Leghorn and a layer strain of New Hampshire cannot be expected to yield better results. The carcass quality was excellent: the generally wanted subdermal fat coating was present, bones were slender and the meat was rich, tender and juicy. The feed conversion is to be regarded from the fact that the starting ration had to include about 50% of a poor quality (lower feed grade) wheat-barley-maize mixture.

Losses never were alarming; signs of definite disease outbreaks were not seen. Remarkable was the increase in death rate on deep litter in the second and third production series (six birds dead out of 50). Gross inspection revealed unspecific enteritis; only a very small number of coccidia could be found in the gut. The losses went down, however, beginning with the fifth series to one or two birds per 50. This observation supports the assumption that a deep litter bedding in the state of being built up has some unfavorable effect on development and health of chicken (Koutz, 1952). Later on, when a certain equilibrium is established, chicken attain more immunity against harmful environmental agents as compared to regularly changed bedding or wire floor. The total loss of all series was lowest, because of the good state of health of birds on deep litter in the second part of the observation period, on this bedding confirming thus the observations of Kennard and Chamberlain (1952).

Final weight and feed efficiency was highest in the first production series on weekly changed bedding and on wire floor whereas on deep litter performance was greatly improved from the sixth production series onward. This type of management brought the best results in the last three series. The findings seem to indicate that the prolonged use of quarters led in all groups to a certain depression of growth, that is generally explained by a rise of the "disease level." On deep litter, however, this regression was overcome after the first half year of continuous use (interrupted only by the periodical treatment of the bedding as outlined above).

At the end of the observation period of about one and a half years, the average growth of the birds on deep litter through all eight production series (each of nine weeks) was in the same order as on wire floor and by more than 3% better than on regularly changed bedding. The feed conversion rate of deep litter kept chicken was superior to that on wire floor by 0.2 and on regularly changed bedding by 0.25 units. Thus the well built up deep litter contributed to the chickens' supply with nutrients to a large extent. This may be explained partly by the observation that metabolites (vitamins, unknown growth factors, antibiotic agents, etc.) are produced by micro-organisms in the lower digestive tract of the birds—where absorption is generally poor (Halama, 1955)—and very likely in the bedding itself (Kennard *et al.*, 1948; Halbrook, 1950). On the other hand immunity of chicken against harmful bacteria and protozoa can develop only when moderate quantities of antigens are available at one time; that is the case in deep litter bedding (Kennard and Chamberlain, 1949). The frequent or immediate removal of faeces with litter or on wire floor, not only prevents the ingestion of metabolites contained therein but also does not allow the birds to acquire immunity and makes them inclined to succumb to an occasional heavier attack of disease producing organisms.

The present findings support, therefore, the opinion that a well built up deep litter bedding—in view of the investigations of Davies and Joyner (1955) special attention is paid to its moisture content — influences development, growth, health and feed conversion of poultry. Overall it was not only the most successful but also the most economical management for broiler production.

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DEVELOPING A MORE PROFITABLE POULTRY INDUSTRY FOR EGG AND POULTRY MEAT PRODUCERS IN BRAZIL

MORLEY A. JULL

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Chickens have a higher reproductive rate and produce eggs and chicken meat relatively more economically than practically all other domestic animals produce their respective food products. In addition, in the United States, at least in the last decade, relatively more progress has been made in improving the efficiency of chicken meat production than the production of pork and milk.

In 1957, officials of the United States Department of Agriculture calculated that a man had to work:

12 hours to produce $100 worth of broilers
19 hours to produce $100 worth of hogs
62 hours to produce $100 worth of milk

The preceding comments are of tremendous importance to poultry raisers in Brazil and indicate the importance of having several Brazilian Government officials sufficiently well trained in the various economic aspects of breeding, feeding, and disease control measures to cooperate with poultry industry leaders and poultry associations in promoting the best interests of the poultry industry. During my short stay in Brazil, I learned that egg and poultry meat producers are very anxious to make improvements and are thirsty for information concerning improved techniques in developing high-

laying strains and the best kind of diets to produce well fleshed broilers, with straight keels, on as few pounds of feed as possible per pound of gain in body weight, the price of chicken meat in Brazil being relatively high. There are relatively few turkeys, ducks, and geese grown in Brazil.

Fig. 1. Dr. Biencha not only carries on an extensive progeny testing breeding plant to increase egg production but was also president of a large poultry association in Sao Paulo. He is an outstanding figure in the poultry industry in Brazil.

Fig. 2. Two of Brazil's outstanding poultry leaders discussing an important poultry problem "on the air." Mr. Bragiolo (left), owner of the largest hatchery, and Mr. Vilhena (right), President of the National Poultry Commission of Brazil.

Fig. 3. This hatchery building was built five years ago and is equipped with modern incubation facilities.

The current tendency is for many of these to become associated with large-scale organizations but it is still a fair estimate to consider the country's annual pullets replacement as emanating from the breeding units with an average flock size of two to five hundred birds, fewer than a dozen having more than one thousand annual replacements. All breeders conform to certain standards regarding housing, equipment, general management and bloodtesting of birds for *Salmonella pullorum*, but a wide latitude of breeding practice is allowed. Two grades of breeders exist, Breeders Grade and General Grade, although a particular farm may include stock in both categories. The former, accounting for some 20 breeders, makes more specific demands regarding pedigree breeding and trapnesting and these units are generally regarded as sources of supply of breeding stock, cockerels in particular, to breeders in General Grade, few of whom follow an intensive pedigree programme and are largely dependent on improvement via the importation of stock cockerels from pedigree sources. They do, however, constitute an important link in the chain from pedigree breeders to commercial poultry keepers and it should be evident that one of the major objectives is the identification of superior strains of proven breeding worth to accelerate the distribution of purebred stock from higher to lower members of the hierarchy and from either of them to the commercial cross. In the latter case the commercial chicken is usually a first cross but pending information on the efficiency of cross-breeding schemes such as Reciprocal Recurrent Selection (which are in certain cases being carried out) there can be little doubt of the validity of upgrading the commercial products via improvement of pure strains. At the same time this is generally to be regarded as more satisfactory to the individual breeder faced with the alternative of maintaining pure strains of little intrinsic merit, or inbred lines of inferior quality, simply because of their ability to cross well. The consequences of efficient pure-breeding techniques and the limitations of new cross-breeding approaches are not sufficiently explored to justify a swing from one to the other and apart from strictly economic reasons there seem to be no grounds for despondency as regards promoting efficient breeding schemes and stock multiplication within the present framework of the accredited scheme. There is thus the double aim of improving commercial stock and of maintaining in the hands of the breeders and multipliers purebred strains of proven merit, capable of producing a high

grade commercial product and capable of producing it in a manner efficient to the breeders themselves.

A further and not least important feature is that, in the process of identifying superior strains, further qualification for Breeders Grade, being contingent on success in the test, the test material should be recorded in such a way as to facilitate flock improvement by the return of proven stock to the individual entrants. Progeny testing at an official centre can never replace selection programmes on the farms but on the present scale of operations it is felt that a useful contribution can be made in this respect.

Should the present position change to one of a direct supply from primary breeder to commercial cross—as it may through the activities of larger hatcheries and the encouragement of large scale progeny testing programmes on the farms —so may the design of the test be altered to constitute a simple test of the commercial product, as with random sample testing in the U.S.A. Strong representations have been made for a test conducted on these lines but well-meaning critics have not appreciated the unsuitability of such a test in our circumstances. Again it must be stressed, we are concerned not only with the commercial product but with the supply of breeding stock for the maintenance of pure-breeds on Breeders Grade and General Grade farms, both operating independently and in their own rights. Success in a simple test of hatching eggs each year might well come to those with no breeding policy of their own other than the exploitation of hybrid vigour from "bought-in" males—all well and good if this identifies a good commercial product but not when it establishes such breeders as the best sources of pure bred stock with material whose hybrid vigour may well be dissipated in subsequent generations. In brief we aim at the identification of superior pure-bred strains *capable of transmitting their good qualities to their offspring*, this being best attained by a double-edged random sample test which includes an actual breeding or progeny testing phase. Again it must be stressed that our main point in progeny testing males is to identify good strains uncomplicated by heterosis and not for the sole purpose of proving individual males.

The outcome is as follows. In the first year of the test a sample of 104 hatchings eggs is taken from all the pure-bred matings of an individual entrant, a total of 45 entries being accommodated. Sampling is stratified, rather than on a purely random basis so that in the case of five breeding pens, ap-

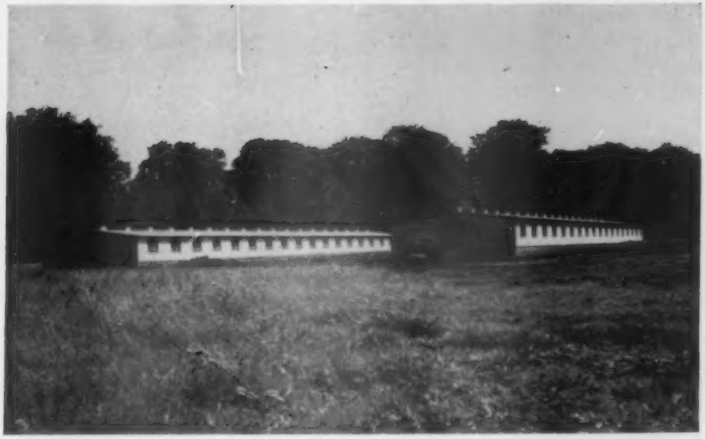


Fig. 1.
Brooder houses used in the Scottish Progeny Testing Scheme.

proximately 20 eggs are taken at random from each, whether flock mated or with a single male. One hundred of the eggs are incubated and the chicks hatched are sexed and wing-banded to the number of the egg, (1 to 104). The number is of course identifiable with the breeders' own pedigree marking All the females are reared under randomised environmental conditions and intensively, as in all stages of the test. Prior to housing in the laying pens a random sample of 24 healthy pullets is taken, testing being with reference to normally acceptable material, without conscious selection of superior birds, but at the same time excluding definite culls which will be debited against the entrant's rearing score. The 24 pullets are housed in two separate pens of 12 each and trapnested for 48 weeks. The method of scoring is not finalised but will be used mainly on hatchability of the original entry, chick rearability, laying house mortality, egg production and egg size.

From the original sample of hatching eggs twelve cockerels will be reared to provide material for the second phase of the test. In the Spring of the second year of the test four representative or typical males from each breeder will be selected for mating to his 24 pullets already under test, the matings being arranged, as in normal practice, to avoid close inbreeding. Mating will be on a double shift system with two males occupying the pens for a few weeks and then being replaced by the others. From these matings a total of 72 pullet progeny will be tested, 18 from each cockerel and an aver-

age of 3 or 4 from each dam, each of the 24 dams having been mated to two cockerels. All progeny will be pedigreed to sire and dam and individually trapped to provide a second phase of scoring as in the first year.

Thus, over a period of two years, each breeder will be judged on approximately 100 pullets in a random or modified random sample performance and breeding test. Results, it is hoped, will be sufficiently accurate to allow publication of a list of successful breeders after the first two years but continuance in Breeder's Grade will depend on maintenance of a satisfactory rolling average and an annual submission of hatching eggs.

At the present time many of the pedigree breeders rely on the use of only a few singly mated pedigree pens used primarily as a source of cockerels for larger male flock matings. Some have been encouraged to adopt a system of sire family selection, developed by the writer, where, with a flock of 1,000 pullets, the birds will be housed in separate pens of 50 corresponding to the progeny of 20 males. Subsequent breeders, male and female, are chosen from the best 4 or 5 sire families as in Hagedoorn's original system but without the inbreeding advocated by him—and the efficiency of the system depending on theoretical grounds alien to Hagedoorn's thesis. This apart, the scope of the official progency test is at least on a par with the breeders' own work. Testing of a random group of males may not be conducive to maximum gains but, serving primarily as a flock test, it may also serve in identifying some parents and progeny worthy of incorporation into the breeders' flocks. Objection has been raised to testing

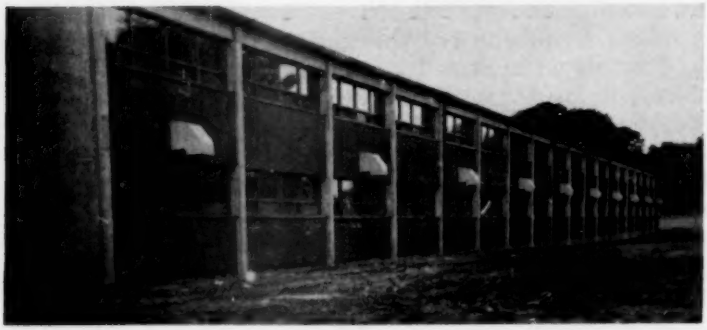
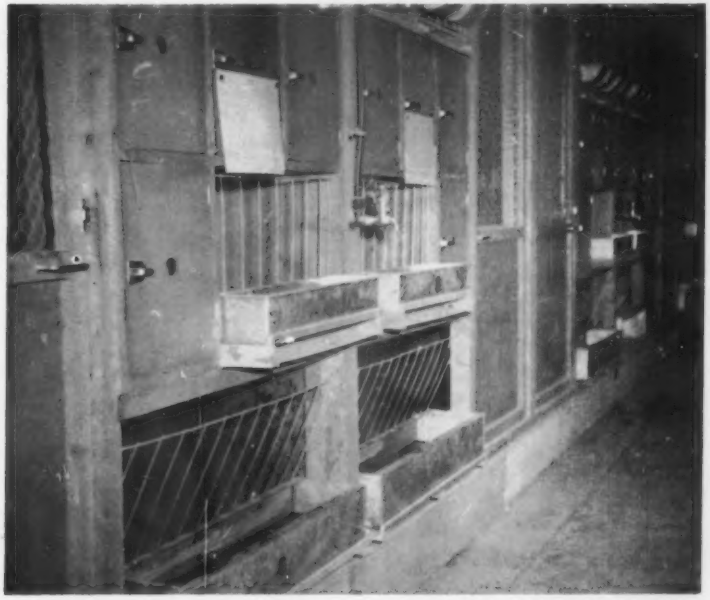


Fig. 2.
A house for laying hens used for the second phase of the Scottish Progeny Test.

Figs. 3 (a) and (b)
Views along the central aisle of the breeding pens at the Scottish Progeny Test.



a male on only 18 progeny but once again modern statistical techniques illustrate the balance to be drawn between testing cockerels accurately, testing enough cockerels to measure a flock accurately, and testing enough to facilitate improvement by selection of the best.

A final personal reflection of the writer is on the obvious value of this scheme for research into breeding methods. Most genetical improvements on selection have been on a purely empirical basis, yielding some useful results, but nevertheless carried out on a practical basis with no underlying theory. Ten or twenty years may be taken up to illustrate the particular consequences of the system followed without advancing any general solution as to optimum methods. These in fact should be predictable by a thorough analysis of unselected randombred flocks, observing the statistical resemblances between parents and off-spring and investigating the consequences and limitations of current theories. Simple and obvious examples are techniques of family selection, the importance of non-additive genetic variations as an indicator of gains to be expected from Reciprocal Recurrent Selection, and the value of judicious culling in a progeny testing programme. The material of the Scottish Progeny Test with, in effect, random bred flocks from 45 sources should be invaluable in this respect. It is hoped, in conclusion, that our experiences and ideas, expounded here at some length, will be of some value in promoting schemes where the problems faced are similar to our own.

(Photos by Courtesy of J. Getty)

THE 1959 POULTRY SCIENCE CONVENTION OF THE AUSTRALIAN BRANCH OF WORLD'S POULTRY SCIENCE ASSOCIATION

The University of Sydney co-operated with the Australian Branch of the World's Poultry Science Association in the holding of a Poultry Science Convention from February 23 to 27, 1959. This was the first long-term, specialized convention ever provided for members of the Australian poultry industry. Educational gatherings in the past had been mainly restricted to one day, although the Victorian Sub-Branch recently "spread" a series of lectures over a number of night sessions.

Professor T. J. Robinson of the Department of Animal Husbandry, at the University of Sydney, was convention president. Following the opening ceremonies; the address of the President; and the reply by Mr. Skaller, representing the World's Poultry Science Association, the program was divided into six sessions.

Session I—*Genetics* occupied the first afternoon and evening period. Mr. F. Skaller, C.S.I.R.O., Poultry Research Centre, Victoria, was chairman. Speakers discussed the following subjects:

1. Some Concepts of Genetics Used in Poultry Breeding.
2. The Application of Some Research Findings to Commercial Breeding.
3. Selection Methods in a Commercial Flock.
4. The Victorian Poultry Improvement Scheme.
5. Can the American System of Poultry Breeding be Applied to Australia?

Session 2—*Physiology and Reproduction.* Under Chairmanship of Professor T. J. Robinson, the second morning included the following subjects:

1. Storage of Poultry Semen for Artificial Insemination.
2. Seasonal and Breed Effects in Cock Bird Fertility.
3. Some Problems Concerning the Mechanism of Light Action.
4. Artificial Lighting and Egg Production.

Session 3—*Poultry Health.* Professor R. M. C. Gunn, Faculty of Veterinary Science, University of Sydney was Chair-

man. Speakers presented the following subjects during the afternoon and evening of the second day:

1. Some Clinical Aspects of Uraemia.
2. The Feather Follicle Method of Vaccinating Baby Chicks with Laryngotracheitis Vaccine.
3. Vitamins and Disease Control.
4. Observations on Nutritional Encephalomacia.
5. Haemorrhagic Diseases of Poultry.
6. Management in Relation to Coccidiosis Control.
7. Laboratory Aspects of the Haemorrhagic Syndrome in Chickens.

Sessions 4 and 5. *Poultry Nutrition.* These sessions occupied Wednesday, the 3rd day. Dr. D. E. Tribe, School of Agriculture, University of Melbourne; and Professor G. L. McClymont, University of New England, served as Chairmen. Seven topics were discussed:

1. The High Energy Ration Concept.
2. What to Feed—When and How.
3. Difficulties of Formulating Broiler Rations in Australia.
4. The Toxic Factors in Low Quality Meat Meal.
5. Synthetic Carotenoids in Poultry Rations.
6. Feed Composition and Egg Quality.
7. Problems in Addition of Micronutrients to Commercial Feeds.

Session 6—*Husbandry, Economics and Marketing.* On Thursday forenoon, the 4th day, Professor Robinson was Chairman with speakers on the following topics:

1. Economics of Egg Marketing.
2. Economics in Poultry Management.
3. Selling 1,500,000,000 Broilers.
4. Feeding and Production Economics in Poultry Farm Management.

On Friday, February 27, visitors to the Convention attended an Open-Day at the Poultry Experiment Station, Seven Hills, Department of Agriculture, N.S.W.

While most of the speakers were Australians, there were two from the U.S.A.: Dr. J. Bauernfeind, Hoffman-La Roche, Inc., Nutley, New Jersey; and Dr. W. H. Pfander, Department of Animal Husbandry, University of Missouri, Columbia, Missouri.

complex. The change of a single allele is a complex genotype may have little or no detectable effect on the phenotype. It is difficult, if not impossible, to evaluate with any degree of accuracy the importance of fluctuations in gene frequency with respect to the drift which they could cause in a quantitative character.

In developing procedures for maintaining and reproducing the Connecticut and Cornell randombred populations, control over those factors known to disturb gene frequency ratios was considered desirable. Little can be hoped for in attempting the control of mutation at the present time, but certainly migration, some types of selection, and some factors involved in random drift are controllable.

Inbreeding, small numbers of breeders, and unequal numbers of offspring have been outlined by Wright (1931) as contributing toward random drift. These can be negated to a large extent by manipulation of the breeding population and procedures in reproducing it. However, that random drift brought about by accidents in sampling, while to some extent minimized by the randomization techniques and population size used, is essentially uncontrollable. The best that can be hoped for is that this drift will not take a definite direction, but rather fluctuate about the general mean for any given trait. Any drift that occurs will be inversely related to population size.

Lerner (1950) defines random mating as that breeding system answering two requirements: (1) that all members of a given population have an equal chance of producing offspring, and (2) that any given ovum has an equal chance of being fertilized by the sperm from any male. In fulfillment of the first requirement, all breeders for the Connecticut or Cornell randombred populations are chosen at random from their respective general populations. Requirement (2) is not fully met in that the restriction is made that once a female is randomly assigned for mating to a given male, all her eggs will be fertilized by the sperm of that male. In a pedigreed population it is not practical to modify this restriction to any great extent. A further restriction is imposed upon the randomness of mating in that no sib or ½ sib matings are made. This is done to help avoid fixation or loss of genes through inbreeding. Since the foregoing restrictions are designed to provide conditions that would exist in an infinite population, it is believed that Lerner's definitions are met adequately.

The aim in establishing these randombred populations was

to assist in the fulfillment of the objectives of the Northeastern Regional Poultry Breeding Project, dealing with genetic and physiologic bases for poultry improvement. The objectives would be served best if the randombred populations were developed with wide genetic bases, which would give ample variability for selection experiments, and maintained through procedures emphasizing the prevention of change in gene frequencies. Accordingly, at least four widely divergent stocks were combined to start each randombred population and maintenance procedures enumerated below were developed.

MAINTENANCE PROCEDURES

At the first meeting of the technical committee of the Northeastern Regional Poultry Breeding Project, a subcommittee on population genetics, comprised of statisticians and geneticists from the Northeast area, was established to assist in problems which might arise in connection with the project.

One of the first problems to be undertaken by this committee was the methods and procedures for forming and maintaining the two randombred control populations. The recommendations as set down by this committee at Cornell University in 1954 are used as the basis of the discussion below.

To prevent genetic change, such as would occur under the influence of migration, after the two randombred populations were formed, no outside genetic material has been or will be added. Matings are made only within the structure of each population. Each year a minimum of 50 males and 250 females of the current replacement flock are randomly selected to be used as breeders by drawings made on paper. Reproduction of the randombred flock is accomplished as early after sexual maturity as is possible to avoid the increasing effects of natural selection. In practice, this approximates 1 generation per year. Each male heads a mating group and his mates are assigned to him at random from the female pool. A restriction imposed upon the randomness of matings is that no sib or 1/2 sib matings are made. Any full or 1/2 sib drawn is thrown back into the female pool and another drawing made. Artificial insemination of breeders is used in this region. Individual pen matings are known to be successfully employed in lieu of artificial insemination in the Northcentral regional project.

It is well known that the number of surviving offspring which is available to a breeding structure in a random breeding population may vary considerably from family to family.

Wright (1931) has discussed the importance of this factor in producing random drift. The ideal situation is one in which all families contribute equally to the effective breeding population. In order to maintain a balance between families in this regard, a restriction has been incorporated into the maintenance procedures which limits each sire to one son and each dam to one daughter in the next breeding population. Sufficient pedigreed chicks are saved and raised from each mating to insure that each sire and dam family will be represented in the succeeding breeding population by a randomly selected son and daughter, respectively. Safeguards are taken to encourage this ideal representation. For example, a minimum of four sons per sire are selected at random at hatching from at least two different dam families designated at random. Three daughters per dam are similarly designated. In cases where extra sons and daughters survive to breeding age, a random selection made just prior to setting up the breeding groups is used to establish which will be saved to represent their respective families.

If a sire has no sons which survive to breeding age, a second drawing is made from the remaining sire families, choosing the replacement sire at random. From this sire's progeny, an additional son is drawn with the restriction that he shall come from a different dam than the son selected on the first round.

Similarly, any dam which leaves no offspring will be replaced by a dam drawn at random in equal proportion as to sire mates. Only one daughter per dam may be used in this replacement category.

No selection or culling of any kind is practiced except that previously accomplished at random on paper. This applies to any reduction in numbers of birds prior to moving to range, at housing time, or when mating groups are formed.

With these maintenance procedures, genetic change which might have occurred under the pressures of migration and artificial selection will be eliminated and a significant reduction in the pressures from natural selection, random drift and inbreeding will have resulted.

THE CONNECTICUT RANDOMBRED CONTROL POPULATION

Four stocks of Columbian-patterned heavy breeds were combined by means of a four way cross to create the first generation of Connecticut controls. It was desired that this

population should contain a sampling of genes from both egg and meat production strains, these to come from as diverse a background as possible. Some idea as to the diversity of this background can be had from the description of each stock given below.

Stock — *Origin and Ancestry*

A. Columbian-patterned segregates obtained from an egg production strain of Barred Rocks recently developed from the crossing of Single Comb White Leghorn, Barred Plymouth Rock, New Hampshire, and Rhode Island Red strains.

B. Columbian-patterned segregates pure for barring obtained from the F_2 of a cross between an egg production strain of Barred Rocks and 3 egg production strains of Rhode Island Reds. Maintained as a closed flock for over 4 generations.

C. Yellow-legged segregates obtained from a strain of Light Sussex. Some New Hampshire genes incorporated. Maintained as closed flock for over 7 generations.

D. Columbian-patterned segregates obtained from a backcross of Barred Cross cockerels to New Hampshire females. Selection primarily for meat and growth characteristics for over 10 generations.

The characteristics of these four original stocks were measured on second generation birds, produced from matings within each of the four pure strains between the same sires and dams used to beget the two way cross progeny which constituted the first leg of the four way cross. From these data, shown in Table 1, the variability which existed between and within the four original stocks can be seen and some idea of the genetic contribution of each to the randombreds can be had.

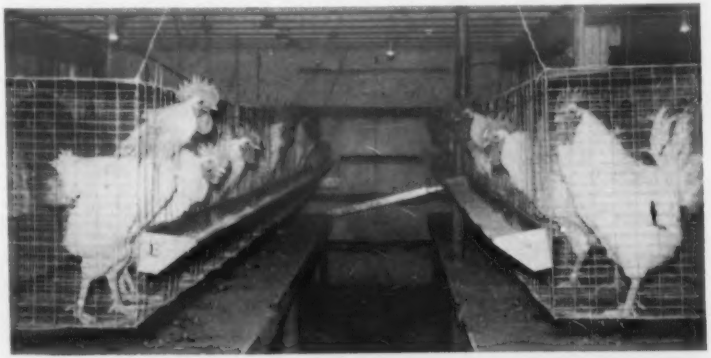
The data in this table are largely self-explanatory, but a few points seem worthy of emphasis. The variability between the original stocks for any given character is high, as was desired, indicating a wide variety of genes for any given character has been combined into the randombred population. For example, hatchability of fertile eggs ranges from a low of 48 per cent in stock B to a high of 94 in stock D. Similarly, mean 8 week body weights in males range between 835 and 1100 grams. Similar variability in the other traits is apparent.

After the pooling of genes from the four original stocks

TABLE I

Characteristics of the 4 Stocks of Columbian-Patterned Chickens Used to Form the Connecticut Randombred Population

Stock	Fast feathering	Nonbarring	Hatch fertile eggs	8-week weight males	Median days to first egg	Body weight at 365 days females	Egg wt. at 365 days	Prod. to 462 days
	%	%	%	grams		pounds	grams	eggs
A	20.0	0	56.9	835.0 ± 66.4	177.0	4.95 ±0.49	62.8 ±3.5	143.4 ±61.9
B	0	0	48.6	943.6 ±153.2	177.5	5.70 ±0.54	58.0 ±5.6	134.8 ±33.9
C	100	100	67.2	973.8 ±107.8	187.0	6.09 ±0.56	61.9 ±3.0	128.4 ±32.5
D	4.2	0	94.2	1100.1 ±100.2	184.5	6.53 ±0.67	62.0 ±4.0	140.7 ±36.8



A sample of the male breeding population of the Connecticut Randombreds.

into the first generation randombreds had occurred in 1955, a closed flock system of breeding has been used, employing 55 males and 275 females as breeders each year. The randombred population is maintained using the methods outlined in a previous section of this paper.

A view of the cage housing of breeding females in the Connecticut Randombred population.

THE CORNELL RANDOMBRED CONTROL POPULATION

The foundation of the Cornell randombred control population was begun in the spring of 1954, when the first chicks for the parents of the population were wingbanded. It was desired to obtain a population of White Leghorns with as wide a genetic base as possible. In order to sample a good variety of White Leghorn strains and accomplish the formation of the population with a gain of at least one generation in time, it was decided to obtain commercial strain cross hatching eggs.

The males utilized for the P_1 generation of breeders consisted of approximately 80 cockerels banded from the Heisdorf and Nelson Farms, Inc., entry in the 5th Central

New York random sample test. This entry was a strain cross that had the highest average rank during the history of the test. Fifty of these males were mated artificially to 250 females, whose derivation is described next.

Fortunately, at the time when the parent stock was being obtained, Babcock Poultry Farms, Inc., had available a large number of female birds derived from all possible two-way crosses of four strains, consisting of the Cashman, Ghostley, Honegger and Owlkill White Leghorn strains. These two-way cross females were flock-mated to males of the Babcock strain and hatching eggs were obtained from the resulting series of three-way crosses. There was not a sufficient number of females available from this source and the slight deficiency was made up with a few excess females from the Brender's Leghorns and Western Cooperative Hatchery, Inc., entries in the Central New York random sample test, both of which were strain crosses. Thus, every chicken hatched in the 1955 season or F_1 generation had at least four different White Leghorn strains represented in its background. It may be well to emphasize that most of these strains had two or more well known White Leghorn strains represented in their early history of development. It is safe to say that it would be difficult to form a population of White Leghorn chickens with a wider genetic background and still stay within the White Leghorn breed.

Since the original P_1 mating in 1955, the Cornell randombred control population has been closed to introduction of new genetic material. The procedure, described in a previous section of this paper, has been utilized in maintaining this flock.

During the 1956 hatching season, pedigreed hatching eggs from the Cornell randombred flock were supplied to the Northcentral Regional Poultry Breeding Laboratory, Lafayette, Indiana. There were three reasons for establishing a second flock:

1. To serve as foundation stock for use as genetic and environmental controls in the NC-47 project.

2. To make it possible to study the relative importance of genetic changes in the two flocks, now bred independently under different environments many miles apart.

3. To reduce the possibility of a major disaster wiping out the control flock with consequent severe damage to the fundamental breeding research of both regions.

UTILIZATION OF RANDOMBRED CONTROL POPULATIONS

GENETIC AND ENVIRONMENTAL CONTROLS

The methods evolved for the development and maintenance of randombred control populations under the NE-6 Regional Project were described and discussed in a previous section of this paper. It is clear that considerable effort is devoted to keeping the gene frequencies constant from year to year in the Connecticut and Cornell randombred control populations. In order to qualify as a good genetic and environmental control, a population should have desirable characteristics as foundation stock, be maintained easily with a constant gene frequency during the span of time when differences due to selection are to be measured, respond to environmental effects in the same direction and to the same degree as selected flocks under study, and be easy to sample as a source of control stock.

In order to study the consequences of selection, it seems desirable that the whole gamut of events in the selection cycle should be investigated, rather than beginning at a point somewhere along the way after a number of generations of selection already have taken place. Thus, a population with a broad genetic base is desirable so that there will be likelihood of considerable genetic variance in the foundation flock. There is every reason to believe that the Connecticut and Cornell randombred flocks qualify admirably on this point.

The great amount of genetic variation existing in these radombred flocks creates a problem, in that it increases the possibility of genetic drift. An earlier section of this paper discussed the steps that are being utilized in an attempt to maintain gene frequencies at a constant level, during the period of time that this feature is required. In addition, experiments are underway to explore as far as possible the importance of genetic drift in randombred populations maintained in the manner outlined.

Long term selection experiments are subject to environmental variations of two kinds: the random year-to-year effects and the long trends in one direction. If one could be sure that only the random fluctuations in environment existed, control populations would not be so important. However, everyone is familiar with the long term trends that have affected the performance of chickens. At one time parasites were the most vexing poultry disease problem, then leucosis

became increasingly important, and more recently respiratory diseases have created havoc in poultry flocks. The introduction of artificial lights marked a tremendous change in the hen's environment. Now there is evidence being brought forth that the manner in which light is applied may be important in egg-laying performance. Nutrition of the laying flock has changed from year-to-year, but no one knows what the absolute effect has been, although everyone agrees that the long term trend has been a great increase in egg production. Many other factors in the management of laying flocks have changed and will continue to change. A method of measuring these environmental changes is required.

Because of the extensive facilities required to evaluate a number of selection systems, especially in a cooperative program undertaken by several experiment stations, it often is not possible to begin each selection system at the same time. In order to compare these systems in terms of progress by generations, it is necessary to remove yearly environmental effects through the use of controls. If all systems to be compared can be started at the same time, their relative value can be determined without the use of control populations; however, a complete evaluation of selection systems should include a measure of absolute genetic gains as well as relative genetic gains.

Of extreme importance in our ability to measure these envirnomental changes is the question of genotype by environment interactions. It is clear that populations with identical genetic constitution would not be influenced by genotype by environment interactions. It is inevitable that selection will produce populations with different genetic constitutions, if genetic variation is available in the foundation flocks. As the genetic differences between populations become greater there is a greater likelihood that genotype by environment interactions could become important. This fact certainly argues that all selection systems to be compared should be started from the same gene pool or foundation flock. At least the effect of the early generations of selection could be estimated fairly reliably, even if genotype by environment interactions did exist in later generations.

Fortunately, some evidence has been accumulated indicating that genotype by environment interactions are of minor importance (Gowe and Wakely, 1954, Merritt and Gowe, 1956 and Lowry, *et al*, 1956). However, it must be admitted that Gowe (1956) did find such an interaction for

survivors egg production and March body weight, though no interaction was found for other traits measured. The results of Hutt and Cole (1947) show that extremes in exposure to disease coupled with extremes in susceptibility to that disease can cause a genotype by environment interaction. It would appear that reasonable efforts to keep the environment as uniform as possible, together with a common foundation flock for all selection systems compared, should result in a minimum of disturbances due to genotype by environment interactions.

Of importance at this stage is the consideration of what can be done if genotype by environment interactions do develop or new experimental evidence convinces us that they are more serious than present data seem to indicate. Clearly, a single control population cannot serve adequately as a control for several different breeding systems that have resulted in populations differing in their reaction to a given series of environments. This is true whether the control is provided by the randombred or the repeat mating procedure. If selection results in the appearance of genotype by environment interactions, a new randombred control population can be established from the selected lines every few generations as required. However, the assumption of important genotype by environment interactions poses serious problems to the investigator and to the commercial breeder. Only the genetic gains which result in favorable performance under a wide variety of environmental circumstances have much practical utility. For this reason it may be preferable to evaluate breeding systems for their average value or additive effects, until we are able to control the environment to the extent of providing a single uniform environment most favorable to the chicken or other animal. Under such a circumstance the genotype by environment interaction becomes a fixed effect peculiar to each system and can be treated as an additive effect as far as the relative value of various systems is concerned.

Another problem concerning genotype by environment interactions which must be considered is the fact that environmental differences often are not predictable. Exposure to disease, year-to-year weather differences and other factors are to a great extent random variables and are not fixed effects peculiar to any one farm, county, state or region. Until we have learned how to control environmental differ-

ences of this type, genotype by environment interactions caused by these factors will have to be averaged out and only the fixed environmental factors need to be considered in the practical use of control populations.

The ease with which the control population can be sampled is important to its efficient utilization in tests or experiments for which it was designed. Drawing a random sample of hatching eggs from a randombred control flock is certainly superior from this standpoint, than the details required to get valid samples for comparison from a repeat mating scheme.

GENETIC PARAMETER STUDIES

Although a great number of estimates of genetic parameters in poultry flocks have been published, these estimates have been made in flocks where selection was a factor to be considered. Daughter-dam regressions have yielded estimates of heritability where the effects of selection need not be reckoned with, but all of the usual variance components estimates have been made in selected flocks, even though this type of analysis assumes that the parents are unselected and mated at random. For this reason, the randombred control flock is an ideal population to utilize in estimating genetic parameters. Further, it is ideal because estimates of genetic parameters in selected populations established from the control population, will yield a great deal of valuable information on the consequences of artificial selection.

CONTROLS FOR RANDOM SAMPLE TESTS

It is common knowledge that the poultry industry has been a rapidly changing industry. Unfortunately, it is difficult to establish the relative importance of various factors influencing the productivity of the nation's poultry flocks over a period of years. By making it possible to separate genetic changes from environmental changes, control flocks in random sample tests would be a long step forward. Most breeders have been satisfied if they could keep ahead of or keep up with their competitors. The relative position of most breeders changes very little over considerable lengths of time. It is suspected that in the quest for genetic improvement of our poultry flocks, there have been instances in which plateaus were reached which continued unrecognized by the breeders.

It is quite possible that most of this stall in progress went on with the breeders unaware of the condition. Control flocks

in random sample tests would make it possible for a breeder to recognize these arrests in progress, take steps to ascertain the cause and possibly revise his breeding program.

CONTROLS FOR COMMERCIAL BREEDING PROGRAMS

There are many facets of a commercial breeding program in which genetic and environmental controls would prove valuable. Perhaps the most important contributions would be the evaluation of genetic progress resulting from the breeders' selection program and, in some cases, the comparison between several selection programs, especially when these differences may be very small. It seems essential that a breeder depending on genetic progress for his livelihood would need to know the net result of his selection program. A control population, probably developed from his own commercial stock, would reveal this information and keep him advised of his progress.

EXPERIMENTAL MATERIAL

Many investigators want to extrapolate and make their results applicable to a wide variety of situations. Utilization of stock from a randombred control population with a wide genetic base is far superior to the use of a highly selected population where the genetic base is likely to have become rather narrow. Thus, many experiments in the fields of nutrition, disease, management and physiology would do well to consider the randombred control flocks as a source of material. It should be emphasized, however, that many fractionation experiments and pilot studies are not designed or intended to be used to make generalized conclusions, and a population with a narrow genetic base may prove more efficient.

COORDINATING MEDIUM FOR REGIONAL PROJECTS

Many problems confronting poultry geneticists are too vast and complex to be undertaken by a single experiment station. Recently, groups of experiment stations have pooled their resources in order to tackle problems too complex to handle individually. Because of the inevitable environmental differences between stations, the randombred control populations make an ideal medium for tying together individual sub-projects. Environmental differences can be accounted for and the utilization of a common gene pool, as foundation stock for selection experiments, make valid comparisons possible. By correlating the fund of knowledge acquired from

many different experiments with these control populations, it may be possible to solve some of the more perplexing problems that would defy solution through disconnected or uncoordinated efforts.

The ways in which the Connecticut and Cornell randombred control populations have been utilized by individual experiment stations in the NE-6 project illustrate their value both as experimental material and as a coordinating medium. The Maine Experiment Station utilizes the Connecticut randombred control population to study the inheritance of feed efficiency and its relation to economic characteristics. Genetic and environmental controls can be obtained each year from the Connecticut station. The variability incorporated in this control population makes it ideal experimental material for the study of fundamental relationships between traits. For the same reasons, this population provides a good source of foundation stock and controls for the New Hampshire project which seeks to evaluate recurrent and closed flock selection. The Rhode Island Station is utilizing the Connecticut randombred controls in order to correct for yearly variations in its selection study on egg quality. West Virginia is using the same procedure in its selection study on growth rate.

Both Connecticut and Cornell randombred control populations make good material for exploratory work on thyroid secretion rate for the Delaware Station. Similarly, the serum cholestrol studies at Maryland can be carried on using the Cornell randombred controls as foundation stock with genetic and environmental controls readily available. The New Jersey experiments to develop high and low lines for blood pressure and the study of the genetic and physiological bases for blood pressure differences or relationships to other traits have utilized the Cornell randombrd controls. Since Delaware, Maryland and New Jersey utilized the same foundation stock and controls, a marvelous opportunity has been provided for integrating the projects of the three separate institutions. The Pennsylvania Station is utilizing the Cornell randombreds as controls in its egg quality studies.

SUMMARY

A heavy breed and a light breed population of randombred controls have been established at Connecticut and Cornell, respectively. These two populations were founded with a broad genetic base and are maintained with a minimum breeding population size of 50 males and 250 females. Random

mating is restricted in that no full or 1/2 sibs are mated in order to help keep genetic drift due to inbreeding at a minimum. Genetic drift due to natural selection is kept as low as possible by permitting each sire to have only one son and each dam only one daughter as breeders in the next generation.

These randombred control populations are utilized as genetic and environmental controls in the NE-6 Regional Poultry Breeding Project and random sample tests. Also, they are used in genetic parameter studies, physiological experiments, nutrition trials and other experiments where a broad genetic base is desired. Samples of hatching eggs are provided to investigators desiring to utilize these control populations in their research work.

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II. Semana de Estudios de Nutricion Animal

Valladolid, Spain—October 7-11, 1959

The Union Castellana—Leonesa de Avicultura (UCLA) and the Soybean Council of America, Inc., are sponsoring meetings on nutrition on October 7-11, 1959.

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THE SCOTTISH POULTRY PROGENY TESTING SCHEME

R. OSBORNE

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In March, 1958, the first entries of hatching eggs were received at the Department of Agriculture for Scotland's Poultry Progeny Testing Station located near Edinburgh. By arrangement with the Agricultural Research Council the writer was seconded to the Department of Agriculture as geneticist to the scheme and to provide advisory services for breeders within the Department's Accredited Poultry Scheme. It may therefore be opportune to present a short account of the test and of its relationship to current breeding activities on the individual farms.

In the words of Major Tom Milne, Chairman of the Working Party of the Scottish Poultry Advisory Committee originally set up to devise a scheme, a reading of the minutes of their numerous deliberations portrays democracy at its best. This situation, however, has arisen naturally because of the many and varied interests of breeders and commercial poultry keepers in Scotland and because of the natural desire to incorporate the better elements of Random Sample Tests and Progeny Testing Schemes in other countries, notably the United States and England. Basically the Scottish plan is an extension of the English scheme in the development of which Dr. R. Coles of the Ministry of Agriculture has played an important part. To justify the test in its present form—in view of the many criticisms leveled at earlier versions and the corresponding test in England—it is necessary to describe briefly the structure of breeding operations in this country.

Poultry breeding in Scotland is predominantly part of general farm enterprises spread over the 58,000 mixed holdings constituting the country's aggregate of agricultural units. With a total poultry population of 9½ million the average commercial flock (as opposed to breeding flock) is thus of the order of one or two hundred birds, mostly first crosses of pure breeds. On the breeding and multiplication side the situation is not radically different and the Department's Poultry Improvement Scheme embraces some 900 members including 600 breeders as such and 300 hatcheries or hatchery supply farms operating as multipliers of stock from accredited sources.

The current tendency is for many of these to become associated with large-scale organizations but it is still a fair estimate to consider the country's annual pullets replacement as emanating from the breeding units with an average flock size of two to five hundred birds, fewer than a dozen having more than one thousand annual replacements. All breeders conform to certain standards regarding housing, equipment, general management and bloodtesting of birds for *Salmonella pullorum*, but a wide latitude of breeding practice is allowed. Two grades of breeders exist, Breeders Grade and General Grade, although a particular farm may include stock in both categories. The former, accounting for some 20 breeders, makes more specific demands regarding pedigree breeding and trapnesting and these units are generally regarded as sources of supply of breeding stock, cockerels in particular, to breeders in General Grade, few of whom follow an intensive pedigree programme and are largely dependent on improvement via the importation of stock cockerels from pedigree sources. They do, however, constitute an important link in the chain from pedigree breeders to commercial poultry keepers and it should be evident that one of the major objectives is the identification of superior strains of proven breeding worth to accelerate the distribution of purebred stock from higher to lower members of the hierarchy and from either of them to the commercial cross. In the latter case the commercial chicken is usually a first cross but pending information on the efficiency of cross-breeding schemes such as Reciprocal Recurrent Selection (which are in certain cases being carried out) there can be little doubt of the validity of upgrading the commercial products via improvement of pure strains. At the same time this is generally to be regarded as more satisfactory to the individual breeder faced with the alternative of maintaining pure strains of little intrinsic merit, or inbred lines of inferior quality, simply because of their ability to cross well. The consequences of efficient pure-breeding techniques and the limitations of new cross-breeding approaches are not sufficiently explored to justify a swing from one to the other and apart from strictly economic reasons there seem to be no grounds for despondency as regards promoting efficient breeding schemes and stock multiplication within the present framework of the accredited scheme. There is thus the double aim of improving commercial stock and of maintaining in the hands of the breeders and multipliers pure-bred strains of proven merit, capable of producing a high

grade commercial product and capable of producing it in a manner efficient to the breeders themselves.

A further and not least important feature is that, in the process of identifying superior strains, further qualification for Breeders Grade, being contingent on success in the test, the test material should be recorded in such a way as to facilitate flock improvement by the return of proven stock to the individual entrants. Progeny testing at an official centre can never replace selection programmes on the farms but on the present scale of operations it is felt that a useful contribution can be made in this respect.

Should the present position change to one of a direct supply from primary breeder to commercial cross—as it may through the activities of larger hatcheries and the encouragement of large scale progeny testing programmes on the farms —so may the design of the test be altered to constitute a simple test of the commercial product, as with random sample testing in the U.S.A. Strong representations have been made for a test conducted on these lines but well-meaning critics have not appreciated the unsuitability of such a test in our circumstances. Again it must be stressed, we are concerned not only with the commercial product but with the supply of breeding stock for the maintenance of pure-breeds on Breeders Grade and General Grade farms, both operating independently and in their own rights. Success in a simple test of hatching eggs each year might well come to those with no breeding policy of their own other than the exploitation of hybrid vigour from "bought-in" males—all well and good if this identifies a good commercial product but not when it establishes such breeders as the best sources of pure bred stock with material whose hybrid vigour may well be dissipated in subsequent generations. In brief we aim at the identification of superior pure-bred strains *capable of transmitting their good qualities to their offspring*, this being best attained by a double-edged random sample test which includes an actual breeding or progeny testing phase. Again it must be stressed that our main point in progeny testing males is to identify good strains uncomplicated by heterosis and not for the sole purpose of proving individual males.

The outcome is as follows. In the first year of the test a sample of 104 hatchings eggs is taken from all the pure-bred matings of an individual entrant, a total of 45 entries being accommodated. Sampling is stratified, rather than on a purely random basis so that in the case of five breeding pens, ap-

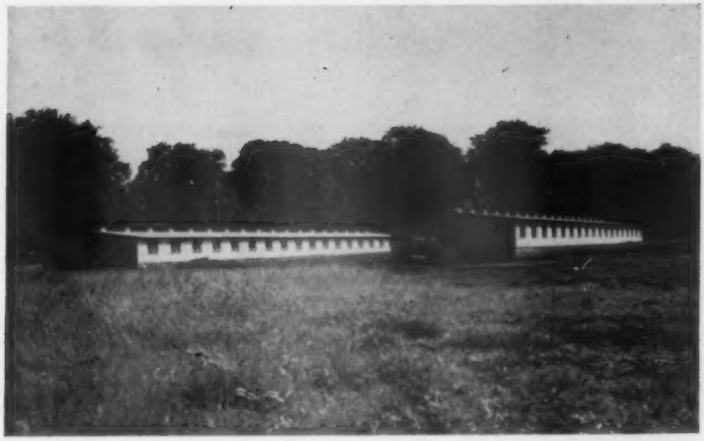


Fig. 1.
Brooder houses used in the Scottish Progeny Testing Scheme.

proximately 20 eggs are taken at random from each, whether flock mated or with a single male. One hundred of the eggs are incubated and the chicks hatched are sexed and wing-banded to the number of the egg, (1 to 104). The number is of course identifiable with the breeders' own pedigree marking All the females are reared under randomised environmental conditions and intensively, as in all stages of the test. Prior to housing in the laying pens a random sample of 24 healthy pullets is taken, testing being with reference to normally acceptable material, without conscious selection of superior birds, but at the same time excluding definite culls which will be debited against the entrant's rearing score. The 24 pullets are housed in two separate pens of 12 each and trapnested for 48 weeks. The method of scoring is not finalised but will be used mainly on hatchability of the original entry, chick rearability, laying house mortality, egg production and egg size.

From the original sample of hatching eggs twelve cockerels will be reared to provide material for the second phase of the test. In the Spring of the second year of the test four representative or typical males from each breeder will be selected for mating to his 24 pullets already under test, the matings being arranged, as in normal practice, to avoid close inbreeding. Mating will be on a double shift system with two males occupying the pens for a few weeks and then being replaced by the others. From these matings a total of 72 pullet progeny will be tested, 18 from each cockerel and an aver-

age of 3 or 4 from each dam, each of the 24 dams having been mated to two cockerels. All progeny will be pedigreed to sire and dam and individually trapped to provide a second phase of scoring as in the first year.

Thus, over a period of two years, each breeder will be judged on approximately 100 pullets in a random or modified random sample performance and breeding test. Results, it is hoped, will be sufficiently accurate to allow publication of a list of successful breeders after the first two years but continuance in Breeder's Grade will depend on maintenance of a satisfactory rolling average and an annual submission of hatching eggs.

At the present time many of the pedigree breeders rely on the use of only a few singly mated pedigree pens used primarily as a source of cockerels for larger male flock matings. Some have been encouraged to adopt a system of sire family selection, developed by the writer, where, with a flock of 1,000 pullets, the birds will be housed in separate pens of 50 corresponding to the progeny of 20 males. Subsequent breeders, male and female, are chosen from the best 4 or 5 sire families as in Hagedoorn's original system but without the inbreeding advocated by him—and the efficiency of the system depending on theoretical grounds alien to Hagedoorn's thesis. This apart, the scope of the official progency test is at least on a par with the breeders' own work. Testing of a random group of males may not be conducive to maximum gains but, serving primarily as a flock test, it may also serve in identifying some parents and progeny worthy of incorporation into the breeders' flocks. Objection has been raised to testing

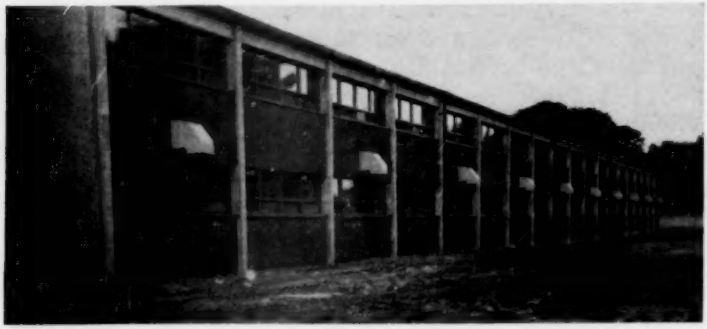
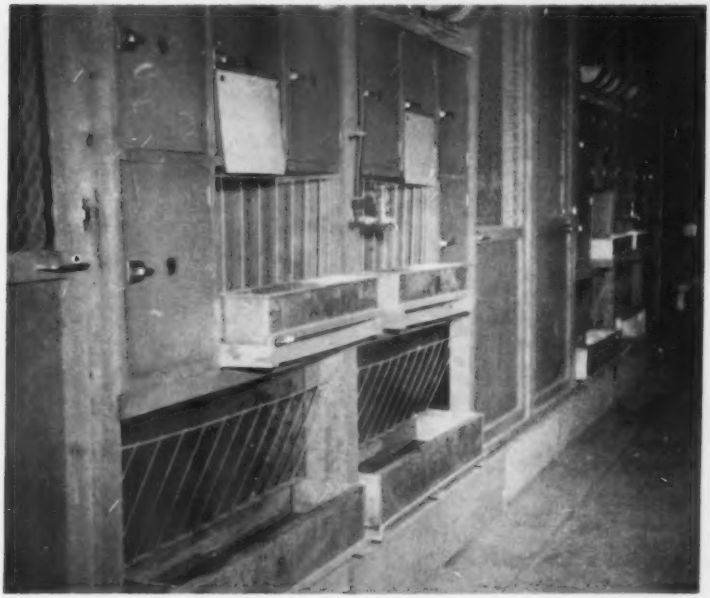


Fig. 2.
A house for laying hens used for the second phase of the Scottish Progeny Test.

Figs. 3 (a) and (b)
Views along the central aisle of the breeding pens at the Scottish Progeny Test.



a male on only 18 progeny but once again modern statistical techniques illustrate the balance to be drawn between testing cockerels accurately, testing enough cockerels to measure a flock accurately, and testing enough to facilitate improvement by selection of the best.

A final personal reflection of the writer is on the obvious value of this scheme for research into breeding methods. Most genetical improvements on selection have been on a purely empirical basis, yielding some useful results, but nevertheless carried out on a practical basis with no underlying theory. Ten or twenty years may be taken up to illustrate the particular consequences of the system followed without advancing any general solution as to optimum methods. These in fact should be predictable by a thorough analysis of unselected randombred flocks, observing the statistical resemblances between parents and off-spring and investigating the consequences and limitations of current theories. Simple and obvious examples are techniques of family selection, the importance of non-additive genetic variations as an indicator of gains to be expected from Reciprocal Recurrent Selection, and the value of judicious culling in a progeny testing programme. The material of the Scottish Progeny Test with, in effect, random bred flocks from 45 sources should be invaluable in this respect. It is hoped, in conclusion, that our experiences and ideas, expounded here at some length, will be of some value in promoting schemes where the problems faced are similar to our own.

(Photos by Courtesy of J. Getty)

THE 1959 POULTRY SCIENCE CONVENTION OF THE AUSTRALIAN BRANCH OF WORLD'S POULTRY SCIENCE ASSOCIATION

The University of Sydney co-operated with the Australian Branch of the World's Poultry Science Association in the holding of a Poultry Science Convention from February 23 to 27, 1959. This was the first long-term, specialized convention ever provided for members of the Australian poultry industry. Educational gatherings in the past had been mainly restricted to one day, although the Victorian Sub-Branch recently "spread" a series of lectures over a number of night sessions.

Professor T. J. Robinson of the Department of Animal Husbandry, at the University of Sydney, was convention president. Following the opening ceremonies; the address of the President; and the reply by Mr. Skaller, representing the World's Poultry Science Association, the program was divided into six sessions.

Session I—*Genetics* occupied the first afternoon and evening period. Mr. F. Skaller, C.S.I.R.O., Poultry Research Centre, Victoria, was chairman. Speakers discussed the following subjects:

1. Some Concepts of Genetics Used in Poultry Breeding.
2. The Application of Some Research Findings to Commercial Breeding.
3. Selection Methods in a Commercial Flock.
4. The Victorian Poultry Improvement Scheme.
5. Can the American System of Poultry Breeding be Applied to Australia?

Session 2—*Physiology and Reproduction.* Under Chairmanship of Professor T. J. Robinson, the second morning included the following subjects:

1. Storage of Poultry Semen for Artificial Insemination.
2. Seasonal and Breed Effects in Cock Bird Fertility.
3. Some Problems Concerning the Mechanism of Light Action.
4. Artificial Lighting and Egg Production.

Session 3—*Poultry Health.* Professor R. M. C. Gunn, Faculty of Veterinary Science, University of Sydney was Chair-

man. Speakers presented the following subjects during the afternoon and evening of the second day:

1. Some Clinical Aspects of Uraemia.
2. The Feather Follicle Method of Vaccinating Baby Chicks with Laryngotracheitis Vaccine.
3. Vitamins and Disease Control.
4. Observations on Nutritional Encephalomacia.
5. Haemorrhagic Diseases of Poultry.
6. Management in Relation to Coccidiosis Control.
7. Laboratory Aspects of the Haemorrhagic Syndrome in Chickens.

Sessions 4 and 5. *Poultry Nutrition.* These sessions occupied Wednesday, the 3rd day. Dr. D. E. Tribe, School of Agriculture, University of Melbourne; and Professor G. L. McClymont, University of New England, served as Chairmen. Seven topics were discussed:

1. The High Energy Ration Concept.
2. What to Feed—When and How.
3. Difficulties of Formulating Broiler Rations in Australia.
4. The Toxic Factors in Low Quality Meat Meal.
5. Synthetic Carotenoids in Poultry Rations.
6. Feed Composition and Egg Quality.
7. Problems in Addition of Micronutrients to Commercial Feeds.

Session 6—*Husbandry, Economics and Marketing.* On Thursday forenoon, the 4th day, Professor Robinson was Chairman with speakers on the following topics:

1. Economics of Egg Marketing.
2. Economics in Poultry Management.
3. Selling 1,500,000,000 Broilers.
4. Feeding and Production Economics in Poultry Farm Management.

On Friday, February 27, visitors to the Convention attended an Open-Day at the Poultry Experiment Station, Seven Hills, Department of Agriculture, N.S.W.

While most of the speakers were Australians, there were two from the U.S.A.: Dr. J. Bauernfeind, Hoffman-La Roche, Inc., Nutley, New Jersey; and Dr. W. H. Pfander, Department of Animal Husbandry, University of Missouri, Columbia, Missouri.

BOOK REVIEW

I. Michael Lerner, 1958. *The Genetic Basis of Selection.* John Wiley & Sons, Inc., New York, pages 298—price $8.00

With clever and ingenious use of words in the outset of the preface the author, with what seems good subtle humor, indicates "that the volume is not intended to be either a handbook of data or a manual of breeding practice." It is then indicated that it is the author's hope "that this work will prove to be of interest and value to advanced students of both evolution and breeding, and, in particular, to those who, having a thorough knowledge of modern genetics, lack an extensive background in mathematics and statistics."

Your reviewer took his basic courses in genetics during his college undergraduate days in 1921-1925. While he did keep up with his reading he must acknowledge that his knowledge of genetics is now limited indeed—and after attempting to read this book he certainly agrees with Dr. Lerner that the book is "not a handbook of data or a manual of breeding practice." However some examination of every chapter does give the definite feeling that no advanced student of genetics, whether evolution or breeding should be without this book—it should be considered an essential and must item in such a student's library. Michael Lerner is an excellent and outstanding scientist which is evidenced by awards he has received among which are: Poultry Science Research Prize, Borden Award and Gold Medal, Belling Prize in Genetics, two research grants from the National Science Foundation. This book was written while he was a Fellow of the J. S. Guggenheim Memorial Foundation. In the 23 years since he received his PhD in genetics at the University of California, he has proved his ability and he has presented more than one new thesis.

For further description of the book your reviewer feels he can do no better than quote a paragraph from the preface in Dr. Lerner's own words.

"In pursuit of this goal a compromise between a romantic (in the sense of free and imaginative) and a classical (i.e. traditionally accepted or long-established) outlook on selection has been adopted. General concepts are introduced at the

(Continued on page 222)

REVIEW OF POULTRY PUBLICATIONS

Compiled by J. W. Kinghorne
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Washington 12, D.C., U.S.A.

(Abstracts from Animal Breeding Abstracts and from *Nutrition Abstracts and Reviews* are reproduced by arrangement with the Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England.

Acknowledgment is also made to Biological Abstracts, University of Pennsylvania, Philadelphia 4, Pennsylvania, U.S.A. for the abstracts taken from *Biological Abstracts.)*

GENETICS

AUSTRALIA: COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION 1958

BREEDING POULTRY FOR HIGHER EGG PRODUCTION. *Leafl. C.S.I.R.O. Aust.*, No. 21: 12 pp.—This leaflet explains two breeding systems—sire family selection and family and individual selection combined—by which breeders can raise the genetic capacity of their poultry; they are based on work in progress at the C.S.I.R.O. Poultry Research Centre at Werribee, Victoria. (Animal Breeding Abstracts)

AXELSSON, JOEL

INFLUENCE OF SOME FACTORS ON HATCHABILITY OF CHICKEN EGGS AND ON GROWTH RATES OF EMBRYOS AND CHICKS. K.—Lantbrukshogskolans Annaler 21: 81-103. 1954.—The influence of some factors on hatchability of chicken eggs and on growth rates of embryos and chicks was studied. Eggs with the greatest weight loss, determined at 20°C in 24 hours after the laying day, were not fit for hatch, and weight loss of the other eggs showed an optimum of the hatching percentage, the highest percentage occurring at a weight loss of normal-sized eggs of 100-160 mg. As to influence of egg size on hatchability the individuality of hens played an important role, though an optimum was suggested, medium-sized eggs being most fitted for hatch. Increased egg size caused a straightlined increase in baby chick weight. When egg weight was increased with 10 g, the raise of chick weight averaged 6.3 g. Chick weight averaged 66.7% of egg weight. The 6-week weight of chicks was increased with 17.3 g on an average, when egg weight was raised with 10 g. Further, baby weight influenced the 6-week weight so strongly that an increase in the baby weight with 10 g caused an increase in the 6-week weight with 29.9 g. Chicks were reared with feed mixtures containing 5.4(lot I), 7.0(lot II) and 8.6(lot III) % of crude fiber in the dry matter. Mortality and feed consumption were independent of fiber content. The digestion coefficients of nutrients decreased in varied degree with increased fiber content. The decrease of the coefficient of organic matter amounted to 2.33 units per increased fiber %. The amount of metabolizable energy per kg of feed averaged 2801 kcal in lot I, 2670 kcal in lot II, and 2,539 kcal in lot III. Weight

gain of chicks amounted to 454 g in lot I, 450 g in lot II, and 432 g in lot III. The gain reached its maximum at a crude fiber content of 5.75% Per kg of weight gain, 3.13 kg of the feed mixture were spent in lot I, 3.18 kg in lot II, and 3.29 in lot III. Baby chicks contained about 59 kcal of energy in the body tissues. The 6-week gain of chicks contained 677.6 kcal of energy in lot I, 708.6 kcal in lot II, and 644.7 kcal in lot III. Of the metabolizable feed energy 17.0% were stored in the chick body in lot I, 18.5% in lot II, and 17.9% in lot III. At a crude fiber content of 7.26% the efficiency coefficient reached its maximum. Feed cost per kg of weight gain was lowest in lots I and II. In its entirety, this part of the experiments proved that 6-7% of crude fiber in the dry matter of the rations of the chicks were most favorable.—Auth. summ. (Biological Abstracts)

BACZKOWSKA, H. 1957. Zielononozka kuropatwiana.
THE PARTRIDGE-COLOURED GREENLEG FOWL. *Przegl. hodowl., 25* (9): 131-134 [English summary.]—The Partridge-coloured Greenleg was developed in southeastern Poland at the end of the 19th century from a native type of poultry with green legs. In egg production it is not greatly inferior to imported breeds, such as the Leghorn or Rhode Island Red. Average production is 132.3 eggs in 365 days from the beginning of lay. In its 2nd laying yr. its yield exceeds that of the 2 imported breeds. (Animal Breeding Abstracts)

BONADONNA, T., and G. C. POZZI. 1957. [1st Sper Ital. "L. Spallanzani" Fecond. Artif., Milan.] Osservazioni sull'azione del fattore luce nei riguardi della produzione spermatica nel *"Gallus gallus"*. (III serie sperimentale.)
THE EFFECT OF LIGHT ON SEMEN PRODUCTION IN *GALLUS GALLUS. III. Folia endocrin.* [*Pisa*] *10:* 137-151. [French and English summaries.]--Twelve 5-mth.-old cocks, divided into 3 groups of 4, were kept in total darkness, constant illumination and in normal conditions of illumination resp. for 124 days, after which some members of each group were interchanged for a further period lasting 90 days. The effects of darkness and constant illumination on semen production and body weight were similar to those observed in a previous experiment. The change from darkness to constant illumination and *vice versa* stimulated semen production temporarily. The size of comb was greatest in cocks kept under permanent illumination. (Animal Breeding Abstracts)

BRANN, V. H. 1958
THE MAIN BREEDS OF POULTRY. DESCRIPTIONS AND STANDARDS. *Agric. Gaz. N.S.W., 69,* 133-145.—A general account. In New South Wales, a change has taken place in the popularity of breeds kept on commercial farms; between the years 1940 and 1957 White Leghorns decreased from 66 to 20% of the population, Australorps from 18 to 12%, while crossbreds increased from 6 to 58%. (Animal Breeding Abstracts)

CHERMS, FRANK LLEWELLYN Jr. (U. Maryland, College Park.)
STUDIES OF A GENETIC INFLUENCE ON SERUM CHOLESTEROL AND ITS RELATIONSHIP TO SEVERAL ECONOMIC CHARACTERS IN CHICKENS.—Dissertation Absts. 19(1): 4-5. 1958. (Biological Abstracts)

CRITTENDEN, LYMAN BUTLER. (Purdue U., Lafayette, Indiana.)
FACTORS AFFECTING THE EFFICIENCY OF SELECTION FOR HATCHABILITY.—Disertation Absts. 18(6): 1925. 1958. (Biological Abstracts)

de MIRANDA ROBERTO MEIRELLES. Estudo dos resultados da incubacao de ovos produzidos e fecundados por reprodutores de diversas idades.
STUDY OF THE RESULTS OF INCUBATION OF EGGS PRO-

DUCED AND FERTILIZED BY REPRODUCERS OF DIFFERENT AGES. [In Portuguese with English summ.] Bull. Inst. Zootecnia [Rio de Janeiro] *15*. 1-19. 1956 [rec. 1958].—Data collected from 1948 to 1954 in the poultry section of the Instituto do Zootecnia were analyzed to determine the possible effect of age of breeding animals on reproduction, under Brazilian conditions. Leghorn cockerels were significantly more fertile than Leghorn cocks.

Cocks were slightly more fertile than cockerels in Rhode Island Reds and New Hampshire breeds. Hatchability of eggs, percentage of dead chicks in the shell, and percentage of abnormal chicks are not affected by the age of the male. Fertility and hatchability decrease, in all breeds, with increasing age of the female, as does the percentage of dead chicks in the shell and percentage of abnormal chicks.—From auth. summ. (Biological Abstracts)

DE MUELENAERE, H. J. H., and **G. V. QUICKE,** 1958. [Agric. Res. Inst., Pietermaritzburg.]

STUDIES ON THE BIOCHEMISTRY OF COCK SEMEN. 1. SEMINAL SUGARS. *S. Afr. J. agric. Sci., 1* (1): 67-74.[Afrikaans and French summaries.]—Analysis of 30 ejaculates from 12 Black Australorp 8- to 9-mth.-old cocks for "total reducing sugars" gave a range of 25-55 mg. per 100 ml. whole semen (av. 35 mg.). Of the so-called "total reducing sugars" yeast fermentable sugars accounted for 92.1%, of which glucose represented 81.6% and fructose (probably) 10.5%; 7.9% of the reducing substances were non-fermentable. These were not identified, and the evidence for the presence of fructose was not altogether convincing. There is some indication that the sugar content of cock semen increases wih the age of the bird. (Animal Breeding Abstracts)

DERANIYAGALA, P. E. P. 1956 [Nat. Mus. Ceylon, Colombo.]

GROWTH, SUBSPECIATION AND HYBRIDISATION IN THE CEYLON JUNGLE FOWL *GALLUS LAFAYETTI*. *Spolia zeylan., 28*, 99-106.—Four species of fowl exist in a wild condition : *Gallus sonnerati* Temminck, the grey jungle cock: *Gallus gallus* (Linné), the red jungle cock; *Gallus varius* (Shaw), the Javan jungle cock; and *Gallus lafayetti* Lesson, the jungle fowl of Ceylon. The last-named is described. Two subspecies are distinguished: *Gallus lafayetti lafayetti* Lesson and *G. l. xanthimaculatus* Deraniyagala. The latter is restricted to the dry areas of Ceylon north of latitude 90°N. Hybridisation has occurred between *Gallus lafayetti* and the domestic fowl. Two ♂ hybrids are very briefly described. In the F_2 generation the bodies of both cockerels and pullets were conspicuously slender and elongate when compared with those of pure domestic birds. The cockerels were marked with large reddish-brown blotches; the marbling closely resembled that of the Sinhala henny game fowl. The F_2 birds were all able to fly long distances and were more timid of human beings than were the F_1 hybrids. (Animal Breeding Abstracts)

GRIGG, G. W., and **F SKALLER.** (Commonwealth Sci. Indust. Res. Organization, Werribee, Victoria, Australia.)

A CASE OF STERILITY IN THE HEN. Poultry Sci. 37(4): 954-955. 1958.—Three hens of a breeding flock of 350 were persistently sterile when artificially inseminated via the vagina with semen from several cockerels of proven fertility. All 3 hens became fertile when the semen was introduced via the funnel end of the oviduct by intraperitoneal insemination. This indicated that a block to sperm transport in the lower oviduct was responsible for the sterility.—G. W. Grigg. (Biological Absracts)

GUHL, A. M. 1958. [Kansas State Coll., Manhattan.]

THE DEVELOPMENT OF SOCIAL ORGANISATION IN THE DOMESTIC CHICK. *Anim. Behav., 6:* 92-111. [B.]—During the first 6 wks. after hatching, ♂ chicks were more aggressive than ♀♀. Cockerels began to show sexual behaviour during the 8th wk., but this behaviour did not become intense until the 15th wk. The first sexual

crouching by pullets was observed during the 18th wk. and the 1st egg was laid during the 21st wk. Cockerels formed a peck-order earlier than did pullets. Androgen-treated and oestrogen-treated ♂ chicks established peck-rights at a slightly lower mean age than did untreated controls. In the oestrogen-treated group the social order tended to be based on negative reactions to specific pen-mates rather than on aggressive actions. In ♀ chicks, oestrogen treatment led to an increase in submissive behaviour and the earlier establishment of a social order, based on avoidance reactions. Capons treated with large doses of androgen established a peck-order sooner than did normal cockerels, but untreated capons were about 4 wks. later than normal ♂♂. The effect of partial isolation and social inertia on the development of dominance relations was also studied. (Animal Breeding Abstracts)

HENDERSON, E. W. 1958 [Dep. Poult. Husb., Michigan State Univ., East Lansing.]
THE INHERITANCE OF EGG SHELL COLOR IN SYNTHETIC MEAT TYPE POPULATIONS OF CHICKENS. *Quart. Bull. Mich. agric. Exp. Sta., 40:* 972-977.—Shell colour was studied in the course of a crossbreeding project in which parental varieties of Red Cornish, Red Laced Silver Cornish, Silver Laced Cornish and a few White Rocks represented the brown-egg strains, and Red, Buff and Black Leghorns the white-egg strains. Using a shell colour score ranging from 1 (white) to 10 (brown), the av. score of the brown egg population was 5.2 and that of the parental white egg population 1.6; that of the F_1 in both directions was 2.4. In a study of the distribution of the crossbred and backcross generations the high percentage of birds with white or near white eggs is evidence of the relative dominance of white shell colour over brown. It appears that at least 4 yrs. would be required to recover the white egg character in substantial numbers from an original cross or hybrid. (Animal Breeding Abstracts)

HICKS, AMP. F. Jr. (U. British Columbia, Vancouver, Canada.)
HERITABILITY AND CORRELATION ANALYSES OF EGG WEIGHT, EGG SHAPE AND EGG NUMBER IN CHICKENS. Poultry Sci. 37(4): 967-975. 1958.—Unweighted average heritability (joint estimate) from data of 2 breeds of chickens (New Hampshires and White Leghorns) in 3 separate years (1953-54, 1954-55 and 1955-56) was .51 for spring egg weight, .25 for the egg production of survivors, and .60 for the spring egg shape index. In the New Hampshire flock there was consistent evidence of sex-linkage in the inheritance of egg weight. Environmental conditions for the Leghorns were considered as "substandard" in 1954-55, and in 1955-56 for the New Hampshires. In "standard" years the gentic correlation between egg weight and egg number averaged -.45, and the environmental correlation averaged .09. In "substandard" years the average genetic correlation was .53 and the environmental corrleation was -.23. Correlations between egg shape and egg weight were consistent with regard to sign for all years, the average genetic correlation being .40 and the environmental correlation -.27. The relationship between egg shape and egg numbers were not definite.—H. Branion. (Biological Abstracts)

HILL, J. F. and **A. W. NORDSKOG.** (Iowa State Col., Ames.)
HETEROSIS IN POULTRY. 3. PREDICTING COMBINING ABILITY OF PERFORMANCE IN THE CROSSBRED FOWL. Poultry Sci. 37(5): 1159-1169. 1958.—The purpose of this investigation was to determine the value of test crosses such as single crosses in the prediction of multiple cross performance in chickens. The influence of sample size on predictability was evaluated and information on general combining ability, specific combining ability and the line cross heritabilites was also obtained. Brooder, range and laying house mortality and age at 1st egg were not highly predictable; 8 week and March body weight, March egg weigth and broodiness were quite highly predictable, while hen-day egg production was intermediate. Information obtained from intra-class correlations indicated that good prediction

of multiple cross performance could be obtained with 20-30 birds in each test cross for 8 week and March body weight, March egg weight, broodiness and hen-day egg production. The 3 periods of mortality and age at 1st egg apparently would require somewhat larger sample sizes since these traits showed less genetic variation. (Biological Abstracts)

HUSTON, TILL M. and **JAMES L. CARMON.** (U. Georgia, Athens.)
THE INFLUENCE OF HIGH ENVIRONMENTAL TEMPERATURE OF FERTILITY AND HATCHABILITY OF EGGS OF DOMESTIC FOWL. Physiol. Zool. 31(3): 232-235. 1958.—New Hampshire, White Plymouth Rock, and White Leghorn males held at high environmental temperatures (90°F) were mated artificially to groups of Leghorn females exposed to the same environment and to females held in uncontrolled environmental temperatures. Similar matings were made with males held in uncontrolled environmental temperatures. Eggs from these matings were incubated and fertiity and hatchability determined. The fertility of eggs from females held in a variable temperature environment was significantly higher than that of the females held at high environmental temperature. Highly statistically significant differences in fertility existed between breeds. Eggs from White Leghorns had the highest fertility; those from the New Hampshires had the lowest; and those from White Plymouth Rocks had intermediate fertility. There was no significant difference between treatments of the males. A significant interaction treatment of male x treatment of female was noted. There was no significant difference in hatchability between eggs from hens held at high environmental temperatures and those held at variable temperatures.—Authors. (Biological Abstracts)

JAAP, R. G. and **B. L. GOODMAN.** 1958.
USE OF DIALLEL AND TRIALLEL MATING SYSTEMS TO ESTIMATE NON-ADDITIVE GENETIC EFFECTS IN POULTRY. *Proc. Xth int. Congr. Genet.* [*Montreal*], 1958, Vol. II (Abstr.): 133.—Within independent 2×2 and 3×3 sets of sire×dam matings the total variance from 2 progeny per mating has been subdivided into that contributed by the sire, by the dam and by the sire×dam interaction. These subdivisions of the variance from 25 to 160 sets were pooled for each trait and components of the mean squares used to estimate the relative magnitude of non-additive effects in both a random-bred and a growth-selected population.

Data were collected for weight of body and body tissues at hatching, growth, and variation in eggs and egg production of ♀♀. Accuracy in estimating the sire, dam and interaction components of the mean squares for the population has been compared by crude estimations of their fiducial limits and, for 8-wk. body weight, by the similarity of duplicate samples of matings.

On a basis of equal amount of effort being expended in data collection, the triallels appear to provide estimates superior to those obtained from diallels. For body weight at 8 wks. of age 225 to 270 matings in triallel composition gave estimated fiducial intervals equivalent to those from 600 matings in diallel form. Since heritabiity estimates from these large numbers of matings still appeared to have fiducial intervals of about 0.7 at a 90% confidence level, a larger number of progeny per mating should aid in reducing the excessive variation observed between sets in each of the sire, dam and interaction mean square components. In the randombred population many of the quantitative traits were observed to be influenced by relatively large amounts of non-additive gene effects. This apparent excessive incidence of non-additive gene interaction may be attributable to the recent crossbred ancestry of the randombred population. (Animal Breeding Abstracts)

KIMBALL, ELLIOT. (Clinton Exptl. Farm, Clinton, Conn.)
ON THE NATURE OF WHITE PLUMAGE. Poultry Sci. 37(3): 730-731. 1958.—Recessive and dominant white plumage in the fowl

depends upon non-transfer of pigment by melanocytes to keratinoblasts. Pigment formation by melanocytes is demonstrable in both forms of white plumage.—E. Kimball. (Biological Abstracts)

KIMBALL, ELLIOT. (Clinton Exptl. Farm, Clinton, Conn.)
ECLIPSE PLUMAGE IN GALLUS. Poultry Sci. 37(3): 733-734. 1958.—Estival molt and black replacement hackles, associated with temporary feminization of physiological origin, occur in pure junglecocks. The phenomena are lacking in all domestic fowl, and in junglefowl X domestic fowl hybrids.—E. Kimball. (Biological Abstracts)

KING, STEVEN C., and **WENDELL H. KYLE.** (Purdue U., Lafayette, Ind.)
EFFECT OF SHIPMENT OF HATCHING EGGS ON FUTURE PERFORMANCE. Poultry Sci. 37(5): 1175-1177. 1958—Hatching eggs were collected for one week from the Regional Cornell Randombred Control population of Single Comb White Leghorn chickens. These eggs were randomized into 8 lots of 15 dozens each, and 4 of the lots were shipped by rail to and from 4 experiment stations (5-7 days in transit). The other 4 lots were stored as controls in Lafayette for 1 week. Both shipped and control eggs were set February 28th in the same incubator. A 2d replicate was treated in the same manner 1 week later. Thirty pullets obtained from each lot of each replicate were housed in separate pens and tested until January 18th. The treatment (shipped vs. controls) mean square was not significant for any of the traits measured on the eggs (fertility and hatchability) or on the pullets (age at 50% production, egg production on a hen-housed or hen-day basis, intensity, 32-week egg weight, body weight at 8 weeks, and 32 weeks, and mortality to 8 weeks, and from 8 to 20 weeks, and in the laying house).—W. H. Kyle. (Biological Abstracts)

KOSIN, I. L. (State Coll. Washington, Pullman.)
TIME-LAG IN IDENTIFICATION OF FERTILITY IN BROAD BREASTED BRONZE EGGS AND ITS RELATION TO HATCHABILITY AND, POSSIBLY, PARTHENOGENESIS. Poultry Sci. 37(5): 1150-1153. 1958.—Broad Breasted Bronze hatching eggs, stored 1-7 and 8-14 days prior to incubation, were first candled 36 hours following setting and then once daily for the next 5 days using 2710 eggs. The time-lag necessary for the initial in-shell detection of fertility was determined and related to hatchability. A higher proportion of the 1-7 day eggs showed a definite tendency to "start" development 36 hours after setting (as indicated by candling appearance) and to hatch better than did the 8-14 day eggs. Some of the latter showed no identifiable signs of development until the 156th post-setting hour. No eggs which had a time-lag longer than 84 hours hatched. Hatchability of those 8-14 day eggs in which fertility could not be identified until 60 hours post setting was higher than that of the 1-7 day eggs. The frequency of retarded embryos was affected by pre-incubation treatment of eggs. Certain inferences are drawn from these observations with respect to the possible prevalence of parthenogenetic development in eggs from mated hens.—I. L. Kosin (Biological Abstracts)

KUSHNER, H. F. 1958. (Inst. Genet., Acad. Sci. U.S.S.R., Moscow.)
INHERITANCE OF CHANGES IN FEATHERING PIGMENTATION IN FOWLS (HENS) SUBJECTED TO FOREIGN BLOOD TRANSFUSION. *Proc. Xth int. Congr. Genet.* [*Montreal*], 1958, Vol. II (Abstr.): 155.—Blood was transferred from New Hampshire fowls and from semi-wild grey ducks to White Leghorn fowls. The progeny were not treated but produced chicks of which 17.3% had partially pigmented feathering and 1.9% had entirely pigmented feathering. Untreated 2nd generation control matings produced chicks of which 26% had parental type feathering and 34% had entirely pigmented feathering. Further similar experiments confirmed that although blood transfusion in fowls does not affect feather colour in the first generations, it frequently

affects their heredity, as in subsequent generations pigmented feathering occurs. The transfer of White Leghorn blood between White Leghorns has produced no deviations from standard W.L. feathering in the 1st generation. Work is being continued. (Animal Breeding Abstracts)

LAW, G. R. J., and I. L. KOSIN. (State Coll. Washington, Pullman.) SEASONAL REPRODUCTIVE ABILITY OF MALE DOMESTIC TURKEYS AS OBSERVED UNDER TWO AMBIENT TEMPERATURES. Poultry Sci. 37(5): 1034-1047. Illus. 1958.—Eighty mature Broad Breasted Bronze males were distributed evenly in 2 environmental groups: outdoor pens (I) and completely enclosed pens with constant temperature of 50° to 60°F (II). Both groups received daily artificial light for 13 hours or more, depending on natural day length. At 2 week intervals for 2 years, pooled semen samples were obtained from 4 males specifically set aside as semen donors in each group. Spermatozoal concentration was determined and semen smears were prepared for morphological examination of the sperm. At similar intervals for 1 year, 2 birds were sacrificed from each group to provide testes, epididymides, vasa deferentia, and thyroid glands for histologic examination. Testes were weighed before fixation but the other tissues were fixed immediately upon excision. During the 1st year spermatozoal concentration was not significantly affected by the environment per se. However, in II there was no reduction in sperm concentration during the 1st autumn. Sperm concentration of both groups was greater during the spring. No semen was produced by I males during the 2d winter, although this group returned to "normal" semen production by April. From that time on the concentration of spermatozoa exceeded that of the indoor group for the remainder of the 2-year period. The frequency of abnormal and immature forms of spermatozoa was greater from Jan. to April. A positive relationship between frequency of abnormal and immature sperms and higher spermatozoal concentration was indicated. Testes weights differed significantly among seasons, with maximum mean weight being in May and June. No significant differences existed in these weights between 2 environments, but the interaction between environments and season was significant. Mean weight of the right gonad was almost double that of the left gonad. The diameter of seminiferous tubules varied significantly between environments, among seasons, and between environments within seasons. Although the seminiferous tubule diameter of testes collected from both environmental groups was reduced in late July and early Aug., it was concluded that the constant temperature condition of the indoor pen partly retarded the apparent natural reduction of spermatogenic activity at this time of year. No significant differences were found in thyroid activity between environments or among seasons when the height of the follicular epithelium was the measure of that activity. However, a seasonal trend within both environmental groups was indicated.—I. L. Kosin. (Biological Abstracts)

LERNER, I. M., E. R. DEMPSTER, and N. INOUYE, 1958. [Univ. California, Berkley.] PRELIMINARY REPORT ON X-RAY INDUCTION OF VARIABILITY IN POLYGENIC TRAITS OF CHICKENS. *Proc. Xth int. Congr. Genet.* [*Montreal*], 1958, Vol. II (Abstr.): 164.—In a flock of White Leghorns selected continuously for egg production since 1933, the mean annual egg production is now about 100 higher than in the foundation stock; selection gains now appear to have decelerated. An experiment was started in 1952 to determine whether further genetic progress could be induced by X-rays. In a randomly selected line (*PX*) the semen of some cocks was exposed to 1000 or 1500 r and used to inseminate randomly selected hens. After cumulative doses of 2000, 3000, and 5500 r were applied, data on production traits were compared in small contemporary samples of pullets from the flock *(P)*, a randomly selected control line *(PC)* and *PX* populations produced with and without irradiation. "In addition, several tests on hatchability without

irradiation of the *PC* and *PX* lines were carried out. Embryo viability seems definitely affected by exposure of semen of grandsires and more remote ancestors to X-rays. Thus the hatchability of the *PX* line is roughly half that of the *PC*, while crosses between them are intermediate. Probably both the means and variances of sexual maturity, egg number and egg weight have been affected. However, the answer to whether the induced variation can contribute to selection progress, will have to wait upon the outcome of the 2nd stage of the experiment in which selection for egg production will be resumed in both the *PX* and *PC* lines." (Animal Breeding Abstracts)

LORENZ, F. W. 1958. [Agric. Res. Coun. Unit Reprod. Physiol. Biochem., Univ. Cambridge.]

CARBOHYDRATE METABOLISM OF COCK SPERMATOZOA. *Nature* [*Lond.*], *182:* 397-398.—A study was made of the carbohydrate metabolism of Rhode Island Red spermatozoa in diluted semen under aerobic and semi-anaerobic conditions. Although notoriously poor in fructose, cock semen in a Ringer phosphate solution to which fructose had been added utilised this sugar under both aerobic and semi-anaerobic conditions. Curves of utilisation of fructose were not linear presumably due to progressive inactivation of incubated spermatozoa and gradual depletion of the substrate.

When the spermatozoa were incubated in mixtures containing fructose and either glucose or mannose, no decrease (and even a slight increase) in fructose was observed. When glucose or mannose was the sole sugar available, an accumulation of fructose was readily demonstrated. The rate of fructose formation was approx. twice as high in aerobic as in anaerobic conditions. Although, in general, fairly independent of the concentration of aldose, the rate of accumulation of fructose was much smaller when the initial concentration of aldose was very small. The formation of fructose in semen supplemented with glucose was dependent on the presence of live spermatozoa. There was no evidence, at least under aerobic conditions, of the ability of cock spermatozoa to convert fructose to glucose or mannose. (Animal Breeding Abstracts)

LOWRY, D. C., and I. M. LERNER, 1958. [Poult. Husb. Dep., Univ. California, Berkley.]

STABILIZING SELECTION FOR SHANK LENGTH CONSEQUENT ON DIRECTIONAL SELECTION FOR EGG PRODUCTION. *Proc. Xth int. Congr. Genet.* [Montreal], 1958, Vol. II (Abstr.): 173.—A line selected for long shanks was derived 20 yrs. ago from a flock of Leghorns bred for egg production and viability [*see A.B.A., 19,* No. 1414.]. Subsequent behaviour of shank length in the egg production line is now being investigated with special reference to reproductive fitness.

It has been established that over an interval of several generations after the truncation of the foundation stock, its mean shank length regained a stable level although no conscious selection was practised for this character. Its variance remained unchanged from that in the original population. During this period artificial selection appears to have favoured birds wtih shank length greater than the mean, excepting those exceeding the mean by 3 or more standard deviations. Thereafter, once the mean had become stable, artificial selection favoured birds with intermediate shank lengths. The variance of birds selected for reproduction throughout the whole period of study was consistently smaller than that of their whole generation.

Differences in reproductive fitness of birds of varying shank lengths can be accounted for entirely on the basis of selection for egg production and viability. That is to say there was no natural selection for either intermediates or extreme shank lengths among dams chosen to reproduce the production-bred flock. This was not the case in the line selected for shank length, in which natural selection began discriminating against extremes after some generations of selection, an effect which disappeared after suspension of selection. (Animal Breeding Abstracts)

MASUI, K., and **K. KONDO.** (Fac. Agric., Nagoya U., Japan.)
THE EFFECT OF FEMALE SEX HORMONE ON SEXUAL DIFFERENTIATION OF THE GONADS IN MALE CHICK EMBRYOS. I. DIFFERENCE IN THE RESPONSE OF THE GONADS TO THE HORMONE BY BREEDS. Proc. Japanese Acad. 33(9): 559-563. 1957.—Eggs of White Leghorn, Rhode Island Reds and Nagoya were used as materials. The female sex hormone, estradiol benzoyl ester, was injected into eggs as near as possible to the embryos on the 5th day of incubation. The minimum quantity of the hormone necessary for transformation of the testis into an ovary was determined. In the 2 inbred lines of White Leghorn 600 I.U. of female sex hormone was proved to be the minimum dosage necessary for bringing about transformation of testis into ovary. In 2 inbred lines of Rhode Island Reds more than 1000 I.U. of the hormone was required to induce transformation to a degree similar to the inbred lines of the White Leghorns. The same results were obtained with the Japanese breed Nagoyas as with the Rhode Island Reds. The authors interpret this difference in response of the gonads to the female sex hormone among the various breeds as due to the difference in hereditary sex determination among these breeds.—Auth. summ. (Biological Abstracts)

MEIRELLES DE MIRANDA, R. 1956. Estudo dos resultados de incubacao de ovos produzidos e fecundados por reprodutores de diversas idades.
THE RESULTS OF INCUBATING EGGS LAID AND FERTILISED BY PARENTS OF DIFFERENT AGES. *Publ. Inst. Zootec.* [*Rio de J.*], No. 15: 19 pp. [English summary.]—Data obtained during 1948-54 from White Leghorn, Rhode Island Red and New Hampshire flocks at the Experimental Section for Poultry and Rabbit Breeding of the Animal Breeding Institute [Brazil] were used to compare the fertility of birds (of both sexes) during their 1st breeding yr. with their fertility during their 2nd breeding yr. Fertility was assessed on the basis of egg fertility and hatching percentage and the occurrence of abnormal chicks. The fertility of ♂ ♂ was lower in their 2nd yr. than in their 1st in W.L.s, but higher in R.I.R.s and N.H.s Age of ♂ had no effect on egg hatchability or percentage abnormal chicks. In ♀ ♀ of all 3 breeds, fertility and hatchability were appreciably lower and percentage abnormal chicks higher in their 2nd yr. (Animal Breeding Abstracts)

MUN, ALTON (State Coll. Washington, Pullman), and **I. L. KOSIN.**
THE EARLY TURKEY EMBRYO. ON MEDIA PREPARED FROM EGGS OF HIGH AND LOW HATCHABILITY HENS. Growth 22(1): 9-15. 1958.—The possible effects of extra-embryonic maternal factors on the development of the turkey embryo were examined by comparing the growth and differentiation of the 36-40-hour turkey embryo on a medium prepared from the yolk and albumen of eggs of high or low developmental potential. The eggs were obtained from 2 groups of hens with a difference in hatchability of greater than 16%. In a majority of cases, eggs from hens with greater than 50% difference in hatchability were used. The medium prepared from the eggs of low development potential was found to be sufficient from sustaining the normal growth and differentiation of the turkey embryo, in vitro, for 24-27 hours. An analysis of the covariance of initial and final lengths of all embryos showed no significant differences between treatments or among hens, the length of the embryo, somite number, length of the area pellucida, and the stage of development, being highly correlated variables. (Biological Abstracts)

PARKER, J. E. (Oregon Agric. Expt. Sta., Corvallis.)
SEASONAL DIFFERENCES IN FERTILITY OF EGGS FROM NEW HAMPSHIRE FLOCKS MATED TO COCKS AND COCKERELS. Poultry Sci. 37(4): 822-824. 1958.—Results from experiments over a two-year period comparing fertility of New Hampshires flock-mated to cockerels and cocks and in which a total of 10,817 eggs were incubated at regular intervals throughout the year show that cockerels fertilized 89.4% of eggs laid by their mates and cocks 76.3%.

Fertility of eggs from flocks mated to both cocks and cockerels varied seasonally, being highest in the fall and lowest the following summer with the summer decline being much more pronounced in cock-mated flocks. Differences in fertility also varied seasonally, increasing sharply from May through August. Little or no difference was observed in hatchability of fertile eggs from flocks mated to cockerels and cocks. (Biological Abstracts)

PILLA, A. M. 1958 [Sta. Sper. Pollicolt., Rovigo.] Ereditabilita dell'indice scheletrico in polli di razza New Hampshire.

HERITABILITY OF THE SKELETAL INDEX IN THE NEW HAMPSHIRE FOWL. *Riv. Zootec., 31:* 156-159.—The skeletal index, obtained by dividing live weight by the circumference of the tarsometatarus, was determined at the age of 60 days in 617 birds over a period of 2 yrs. There was a correlation of 0.974 between the tarsometatarsal circumference and live weight, and of 0.963 between the skeletal index and live weight. The heritability of the skeletal index, calculated from the intra-sire regression of offspring on dams, was 43.1%. Combined selection for both high skeletal index and live weight is recommended. (Animal Breeding Abstracts)

SATO, I., and **I. L. KOSIN.** 1958. [Dep. Poult. Sci., State Coll. Washington, Pullman.]

CHROMOSOME COMPLEMENTS IN PARTHENOGENETIC TURKEY EMBRYOS. *Proc. Xth int. Congr. Genet.* [*Montreal*], 1958, Vol. II (Abstr.): 249-250.—The incidence of parthenogenetic development is high in turkey eggs but embryos form in only 4% of the germ discs and embryonic development is retarded. The diploid chromosome complement in turkeys is 18 macrochromosomes including 2 sex chromosomes in ♂♂, and 17 macrochromosomes including 1 sex chromosome in ♀♀; in addition, both sexes have about 60 microchromosomes. Considerable variation was noted in the choromosome number of somatic diploid cells from parthenogenetic embryos and tissues. (Animal Breeding Abstracts)

STROUN, J. H., L. R. STROUN-GUTTIERES, J. ROSSI, and **M. STROUN.** 1958. [Lab. Rossi, Geneva.] Modifications de la poule Leghorn traitee par de sang de pintade.

MODIFICATIONS IN THE LEGHORN FOWL TREATED WITH GUINEA-FOWL BLOOD. *Proc. Xth int. Congr. Genet.* [*Montreal*], 1958, Vol. II (Abstr.): 280.—Guinea-fowl blood administered to Leghorn chicks until sexual maturity induced modifications in the progeny of the Leghorns. (Animal Breeding Abstracts)

STUTTS, ENSEL C., and **H. O. KUNKEL.** (Texas Agric. Expt. Sta., College Station.)

REDUCED GLUTATHIONE CONCENTRATION IN RELATION TO THE AGE AND WEIGHT OF NEW HAMPSHIRE AND WHITE LEGHORN EMBRYOS. Poultry Sci. 37(4): 914-924. 1958.—Total reduced glutathione (GSH) contents in 10-or-12-to-20-day New Hampshire and White Leghorn embryos were compared in 2 experiments. The highest concentration of GSH per unit weight occurred on the 13th day of incubation in the New Hampshire embryos and on the 14th day in White Leghorn embryos. Heterogonic analyses indicates 3 distinct rates of GSH accretion when compared to embryo weights: In embryos weighing from about 2 to 10 g, the hetergonic constant or ratio of rate of increase in GSH to rate of embryonic growth is above unity; in embryos weighing from about 10 to 19 g, the ratio is much less than one; and in embryos weighing from about 20 to 35 g, the ratio is again greater than one. In the 2 to 10 g embryos, the heterogonic constant for White Leghorns was significantly higher than for the New Hampshires, but in embryos weighing more than 10 g the 2 constants for the New Hampshires were significantly greater. Results suggest that the pattern of net synthesis of glutathione by the developing chick embryo is, in part, under hereditary control. (Biological Abstracts)

TAYLOR, L. W. 1958. [Dep. Poult. Husb., Univ. California, Berkeley.] FURTHER STUDIES ON DIPLOPODIA IV: BREEDING PERFORMANCE OF A PRESUMABLY HOMOZYGOUS DIPLOPOD MALE. *Proc. Xth int. Congr. Genet.* [*Montreal*], 1958, Vol. II (Abstr.): 290-291.—Di[illegible] simple recessive which is almost always lethal. In 15 yrs. 1 ♀ and 2 ♂♂ exhibiting weak expressions of diplopodia reached maturity. The 1 ♂ that was fertile was mated by A.I. to hens in 2 lines of diplopod carrier ♀♀ significantly differing in phenotypic segregation ratios. The ♂ was shown to be homozygous for the diplopod gene. The superior viability and reproductive performance of this diplopod ♂ may be related to the fact that he originated in the 3rd generation following an outcross of 2 diplopod lines to a non-related inbred strain of White Leghorns. (Animal Breeding Abstracts)

THOMAS, C. H., W. L. BLOW, C. CLARK COCKERHAM, and **E. W. GLAZENER.** (North Carolina Agric. Expt. Sta., Raleigh.) THE HERITABILITY OF BODY WEIGHT, GAIN, FEED CONSUMPTION, AND FEED CONVERSION IN BROILERS. Poultry Sci. 37(4): 862-869. 1958.—In an exeperiment extending over 7 trials, heritabilities for weight at different ages, and gain, feed consumption and feed conversion during different periods were estimated for broilers. The data, which involved 1196 progeny from 56 sires and 218 dams, were analyzed on the basis of mean performance of the offspring of the same sex from the various matings. Separate analyses were made for male progeny, female progeny and all progeny. Estimates of heritability for weight at various ages were generally higher than those previously reported for this character. Estimates of heritability for gain and feed consumption during various periods generally ranged from .6 to 1.0, while estimates for feed conversion were considerably lower for the same periods. A divergence in the estimates of heritability from male and female progeny for the same character presented some evidence that sex-linked genes are of considerable importance in the expression of these characters. The effects of sex-linkage on parental components of variance and on estimates of heritability from male and female progeny were discussed. (Biological Abstracts)

VERDIEV, D. G., and **G. M. GADZIEV,** 1958. [Azerbaijan Anim. Breed. Vet. Inst.] Opyt izucenija rosta i mjasnyh kacestv cypljat raznyh porod v Azerbaidzanskoi SSR.

THE GROWTH AND MEAT CHARACTERS OF VARIOUS BREEDS IN THE AZERBAIJAN S.S.R. *Ptice-vodstvo, 8(6)*: 27-29.—In 1956, 800 eggs from the indigenous hens, 500 Australorp eggs, 500 New Hampshire, 400 Rhode Island Red, 500 Pervomai and 260 Plymouth Rock eggs were incubated and all the chicks were reared together. Data on body weight are tabulated for ♂♂ and ♀♀ of each breed and additional data are tabulated to show body measurements and carcass characters of the indigenous birds. (Animal Breeding Abstracts)

WATANABE, MORIYUKI. (Hiroshima U.) AN IMPROVED TECHNIQUE OF THE ARTIFICIAL INSEMINATION IN DUCKS. Jour. Fac. Fish. and Animal Husbandry Hiroshima Univ. 1(3): 363-371. Illus. 1957.—Drake semen could be easily collected by intermittent passage through the duck of 30 volts AC at 0.06 to 0.08 amperes. For insemination a special speculum and a glass pipette were used. There is no worry of infection and injury to the female genital tract. (Biological Abstracts)

WILCOX, F. H., and **C. S. SHAFFNER,** 1957. [Dep. Poult. Husb., Univ. Maryland, College Park.] EFFECT OF DIFFERENCES IN SALT AND HYDROGEN ION CONCENTRATION ON THE FERTILIZING ABILITY OF AVIAN SPERM. *J. appl. Physiol., 11:* 429-434.—Semen from ♂♂ of a flightless strain was diluted with solutions having different salt concentration and *p*H, and held at 50°-52° F. for 3½-7 hrs., following which it was

inseminated into White Leghorn ♀♀. Varying concentrations and proportions of Na_2HPO_4 and $NaH_2PO_4.H_2O$ were used in the diluents. Fertility was maximum when the freezing point depression of the diluent was between 0.607 and 0.639° C., but decreased gradually outside of this range. There was little difference in fertility between *p*H 6.47 and 7.95, but outside of this range there was a marked decline. The optimum *p*H appeared to be between 7.03 and 7.27. Motility was found to be an approximate measure of fertilising ability with varying salt concentration and a poor measure when varying *p*Hs were used. Hatchability was not adversely affected when eggs were fertilised by diluted, stored sperm. (Animal Breeding Abstracts)

WILLIAMS, CLETIS (Honegger Farms Co., Forrest, Illinois), and **W. H. McGIBBON.**

THE RELATIONSHIP BETWEEN THE VARIOUS MATING ACTIVITIES OF THE FEMALE DOMESTIC FOWL. Poultry Sci. 37(3): 515-519. 1958.—The crouching of a female for a male did not influence greatly the decision of the male to attempt a mating. The number of escapes by a female from a male was directly proportional to the number of matings attempted by a male. Females which crouched frequently for the males escaped less frequently. Females which crouched often for the males had a higher percent completion of matings attempted. Of the total variation in percent fertility among the females in this study, attempted matings accounted for approximately 11.2%, completed matings 31.8%, the percent completion of matings attempted 36.6%, crouching 1.3%, and escapes 10.8%. Escapes during attempted matings accounted for approximately 19% of the total variation in percent completion of matings attempted, while crouching accounted for 24%. (Biological Abstracts)

WOOD-GUSH, D. G. M. 1958 [Agric. Res. Coun. Poult. Res. Centre, Edinburgh.]

THE EFFECT OF EXPERIENCE ON THE MATING BEHAVIOUR OF THE DOMESTIC COCK. *Anim. Behav.*, *6*, 68-71—No clear-cut difference in behaviour towards ♀♀ was found between 4 Brown Leghorn cockerels reared singly, in isolation from other birds, until the age of 6¼ mths. and 10 control cockerels reared in the usual way, *i.e.* kept in an all-♂ pen from 8 wks. to 6½ mths. of age. In each group behavioural differences were observed between ♂♂. There was evidence that social facilitation may play an important role in the adjustment of some cockerels, but where the sex drive is strong enough, normal courtship can occur without previous experience. Attention is drawn to the possibility that in some ♂♂ the sex drive may be diminshed by the common practice of isolating the sexes. (Animal Breeding Abstracts)

YAMADA, Y. 1958. [Nat. Inst. Genet., Misima.]

HERITABILITY AND GENETIC CORRELATIONS IN ECONOMIC CHARACTERS IN CHICKENS. *Jap. J. Genet.*, *33:* 13-22.—Over a 4-yr. period a study was made of sexual maturity, body weight, and rate of egg production in a closed flock involving 3 breeds (White Leghorn, Barred Plymouth Rock and Rhode Island Red) mated more or less at random. Heritabilities, based on combined sire and dam components, were estimated to be 0.48 for sexual maturity, 0.31 for winter egg production (1st Dec. to the end of Feb.), 0.17 for spring production (1st March to the end of May), 0.15 for total production (1st egg to the end of May). 0.43 for body weight at 1st egg, 0.46 for body weight at 300 days, and 0.49 for egg weight at 1st egg. It is concluded from the data that, in the population under study, individual selection would be most effective for improving body weight and egg weight, whereas family or combination selection would be more effective for improving egg production. A high genetic correlation was found between total rate of egg production and either winter or spring rate, but the correlation between the winter and spring rates was fairly low. That between

sexual maturity and winter egg production was -0.21, and that between winter rate and body weight at 300 days was 0.173.

A selection index suitable for use under Japanese conditions was constructed. The genetic gains to be expected as a result of selecting on this index are indicated. (Animal Breeding Abstracts)

YAMASHINA, Y. 1956.
STUDIES ON THE ELIMINATION OF BROODINESS IN DOMESTIC FOWL BY THE USE OF PROLACTIN (V). BROODINESS IN THE PLYMOUTH ROCKS OBTAINED FROM THE CROSS WITH THE COCKS WHICH WERE PROVED UNBROODY BY PROLACTIN-INJECTION. *Misc. Rep. Yamashina's Inst. Orn. Zool. [Tokyo]*, No. 8: 311-317. [Japanese with English summary.]—From abstract in *Biol. Abstr.*, 1958, *32*, No. 20158.—From a stock of Plymouth Rocks showing 83-86% broodiness, 3 cocks which were not made broody by prolactin injection, and 2 hens which showed no or very weak broodiness, were selected. As a result of 5 yrs. (1950-54) of interbreeding of these 5 parental birds and their offspring, a total of 129 hens was obtained. Of these hens, only 5 showed broodiness and all the rest were non-broody. The percentages of broody hens abruptly decreased from the original 84.5 to 3.8, indicating the usefulness of the prolactin-injection method for broodiness elimination in the domestic fowl. (Animal Breeding Abstracts)

YAO, T. S. (U. Nebraska, Lincoln.)
EGG PRODUCTION PERFORMANCE OF SINGLE AND FOUR-WAY INCROSSBRED CHICKENS. Poultry Sci. 37(3): 602-609. 1958.—Comparisons of egg production, production rate, and egg size were made among populations of the 8 groups of single incrossbred, 32 groups of four-way incrossbred, and 8 sire-family rgoups of randombred chickens, involving 1621 pullets. Results show that crosses with Leghorns used as males had higher egg production, but smaller egg size and lower laying-house livability than those with the heavy breed birds (Rhode Island Reds x White Rocks) used as males. The single incrossbreds were superior in egg production, while the four-way incrossbreds were superior in egg size. Results of analysis of variance components show that among the 3 populations single incrossbreds had the largest genetic variabilities in these 3 characters, and would be most effective with selective breeding. The correlation coefficients of daughter and dam performances show that selection amoung parental groups would considerably increase egg production and production rate of four-way incrossbreds, but not those of the single incrossbreds. (Biological Abstracts)

PHYSIOLOGY

ANCEL, P. 1958. [Lab. Embryol. Exp., Coll. France, Paris.] Recherches sur l'action teratogene du refroidissement temporaire de l'oeuf de poule au cours de l'incubation.]
INVESTIGATIONS ON THE TERATOGENIC EFFECT OF TEMPORARY COOLING OF THE HEN'S EGG DURING INCUBATION. *J. Embryol. exp. Morph., 6:* 335-345. [English summary.]—Interruption of incubation of the hen's egg for 2-3 days has a lethal effect and a teratogenic effect. The stage at which maximum numbers of each variety of malformation are obtained varies according to the localisation of the malformation: cooling of the eggs between the 4th and 6th day for hare-lip, between the 5th and 7th for ablephary or malformations of the eyelid, between the 6th and 8th for atrophy of the bill, and between the 7th and 9th for malformations of the limbs. (Animal Breeding Abstracts)

BAKER, R. C., and **W. J. STADELMAN.** (Purdue U., Lafayette, Ind.)
CHICKEN EGG CHALAZAE-STRAIN AND INDIVIDUAL HEN VARIATIONS AND THEIR RELATION TO INTERNAL QUALITY. Poultry Sci. 37(3): 558-564. Illus. 1958.—Eggs from 75 strains and

crosses of chickens were used to study heritability of chalaza prominence. Ninety-two strains and crosses were used to determine relationships between prominence of chalaza and other quality factors of broken out eggs. A 3rd study was made to determine consistency of chalaza prominence in eggs from individual hens. The rate of change in chalaza prominence during storage of eggs was investigated with the following results. Prominence of chalaza in chicken eggs is a heritable characteristic. There is no correlation between prominence of chalaza and other internal egg quality characteristics. Hens exhibit a heterogeneity of variance as far as prominence of chalaza is concerned. Chalaza cords do not deteriorate as rapidly as the rest of the thick white. (Biological Abstracts)

BAKER, ROBERT CARL. (Purdue U., Lafayette, Indiana.)
CHALAZAE OF THE DOMESTIC FOWL-LYSOZYME CONTENT AND FACTORS AFFECTING THEIR PROMINENCE. Dissertation Absts. 18(1): 12. 1958. (Biological Abstracts)

BALDISSERA NORDIO, C. 1958 [Ist. Anat. Fisiol. Anim. Domest., Milan.]
Ricerche isto-fisiologiche intorno all'influenza del progesterone sulle gonadi, sui caratteri sessuali secondari, sulla ipofisi e sui surreni, sulla maturita sessuale, sulla produzione di uova e sull'accrescimento della prole di Leghorn White×New Hampshire.
THE EFFECT OF PROGESTERONE ON THE GONADS, SECONDARY SEXUAL CHARACTERS, HYPOPHYSIS, ADRENALS, SEXUAL MATURITY, EGG PRODUCTION AND GROWTH IN WHITE LEGHORN×NEW HAMPSHIRE CROSSES. *Atti. Soc. ital. Sci. vet.*, 1957, *11* (Suppl. to *Arch. vet. ital.*, *9*, No. 2): 329-331. [French and English summaries.]—Intramuscular administration on alternate days of 5 mg. progesterone for a period of 40 days was followed by hyperfunction of the gonads in both ♂ and ♀ chicks, but egg production, although initiated at an earlier date, was inferior compared to that of controls. Hatching percentage was also lower than in the case of the control birds, but growth rate of offspring was higher. (Animal Breeding Abstracts)

CORBIN, A. 1957. [City Coll., New York.)
RESPONSE OF THE WHITE LEGHORN COCKEREL TO MALE AND FEMALE HORMONE AND SUBSEQUENT COMB-TESTES RELATIONSHIP. *Biol. Rev.* [*City Coll. N.Y.*], *19 (1):* 8-10. Abstract in *Biol. Abstr.*, 1958, *32*, No. 1259, copied *verbatim*.—White Leghorn cockerels (56) were injected with testosterone propionate (TP) and diethylstilbestrol (DST) both alone and in combinations, from days 5 to 24. All, except the 5 μg. TP+0.5 μg. DST treated chicks, showed a marked inhibition of comb growth. The 5 μg. TP + 0.5 μg. DST treated chicks had testes which were comparable to those of normal controls and which were considerably larger than those of the [other] experimental animals. (Animal Breeding Abstracts)

JUHN, MARY, and **PAUL C. HARRIS.** (U. Marvland, College Park.)
MOLT OF CAPON FEATHERING WITH PROLACTIN. Proc. Soc. Exptl. Biol. and Med. 98(3): 669-672. 1958.—Adult capons were treated with prolactin (LTH), follicle stimulating hormone (FSH), luteinizing hormone (LH), singly or in combination with a constant progesterone (Pg) dosage. In addition, Pg was administered alone. Pg was effective in activating the castrate feather papilla, these findings confirming earlier responses obtained in both intact sexes of fowl by others. FSH and LH were both ineffective in stimulating capon feather regeneration; in combination with Pg, the reaction was similar to that toward Pg alone. LTH uniformly caused molt of capon feathering whether given alone, in combination with Pg, or alone as a highly purified preparation. The positive performance of LTH in the male castrate feathering described here, together with the observed lack of response

toward FSH and LH in this fowl, suggests that prolactin may be the immediately effective agent in stimulating the feather papilla to production of new plumage. (Biological Abstracts)

KRIZENECKY, JAROSLAV, JOSEPH SAJNER, and RUZENA J. VANCIKOVA. (Slovakian Acad. Sci., Ivanka on Danube.)
A CASE OF A HEN YOLK WITH SEVEN BLASTODISCS. Poultry Sci. 37(3): 512-514. Illus. 1958.—A yolk with 7 blastodiscs in an unfertilized egg is described. Five of the discs were of normal size and 2 were smaller. No other eggs laid by the same hen had more than 1 blastodisc. The origin of the 7 cannot be explained by fusion of yolks. (Biological Abstracts)

LACASSAGNE, L. (Sta. Rech. Avicoles, C.N.R.Z., Jouy-en-josas, France.), Dynamique de l'Ovogenese. Contribution a l'etude de la phase de grand accroissement des follicules chez la poule domestique.
DYNAMICS OF OVOGENESIS. CONTRIBUTION TO THE STUDY OF THE PHASE OF FULL DEVELOPMENT OF THE FOLLICLES IN THE DOMESTIC HEN. Ann. Inst. Natl. Rech. Agron. Ser. D. Ann. Zootech. 6(2): 85-93. Illus. 1957.—A new technique is described employing the ingestion of fat-soluble dyes to define the evolution of yolk development during the laying period and to determine the number of follicles in the stage of full development at the level of the ovary. Results indicate that the number of follicles in evolution varies constantly with time and is closely associated with the length of the series. The time required for an individual follicle to attain maturity is dependent upon the number of follicles in evolution on the ovary. (Biological Abstracts)

LUBIS, D. A.
RELATION BETWEEN EGG-WEIGHT AND THE CALORIC VALUE OF THE EGG IN FOWLS AND THAT BETWEEN EGG-WEIGHT AND THE CORRESPONDING BABY-CHICKEN. [In English with Dutch.] Hemera Zoa 63(11/12): 485-494. 1956.—A study was made of the relation between egg-weight and caloric value (gross energy value) of the egg and that between egg-weight and the corresponding baby-chickens. It is stated that caloric value, as well as weight of chickens, is asociated with egg-size. A decrease in one factor is attended with an increase in the other one. Mathematical analysis of statistics led to the following regression equations: I: $Y = 215.327 - 0.983\ X$, in which X = egg-weight, and Y = caloric value. II: $Y = 93.745 - 0.4417\ X$; here X = egg-weight, and Y = chicken weight expressed in percentage of egg-weight. (Biological Abstracts)

MORGAN, W. C., and R. GREB. 1958. [South Dakota State Coll. Brookings.]
EVOLUTIONARY IMPORT OF A NEWLY DISCOVERED MUTATION AFFECTING THE GENITAL SYSTEM IN POULTRY. *Proc. Xth int. Congr. Genet.* [*Montreal*], 1958, Vol. II (Abstr.): 193-194.—Bilateral oviducts occur in over 75% of the hens in a line of Rhode Island Reds at the South Dakota Experiment Station; no right ovary has been observed. No corresponding effect has been seen in the ♂♂. It is possible that the mutation may be located on the disputable ♀ sex chromosome inasmuch as in birds the ♀ is the heterogametic sex. The presence of 2 oviducts suggests a reverse-mutation, a return to the primitive state. Histological sections and the pedigrees of the mutant ♀♀ are being studied. (Animal Breeding Abstracts)

RUUS, C. H. 1958. [Estonian Agric. Coll.] Osobennosti rosta gusei, vyvedennyh pri peremennoi temperature.
CHARACTERISTICS OF THE GROWTH OF GEESE INCUBATED IN A VARYING TEMPERATURE. *Pticevodstvo. 8(6): 36-38.*—For the first 14 days of incubation 250 experimental goose eggs were sprinkled with cold water (9°-12°) twice daily, and the 250 control eggs were treated in the same way as hen's eggs. During the remainder of incubation both groups were cooled in a temp. of 19.4° for

20-60 mins. [? daily] and then sprinkled with cold water. The hatchability rates in the 2 groups were 81.2 and 72.0% resp. of eggs set and 90.2 and 79.3% of the fertile eggs. In the experimental group chick mortality to 10 days of age was lower and body weight greater than in the control group. (Animal Breeding Abstracts)

STURKIE, PAUL D. (Rutgers U., New Brunswick, New Jersey.)
A SURVEY OF RECENT ADVANCES IN POULTRY PHYSIOLOGY. Poultry Sci. 37(3): 495-509. 1958.—This article is a brief review of recent advances in selected subject matter areas of avian physiology, including certain aspects of heart, blood and circulation, energy metabolism and digestion, and physiology of reproduction and pituitary. Most of the review deals with selected papers, appearing since 1953. It is pointed out that there has been a significant increase in recent years in the amount of research work and research workers in avian physiology. (Biological Abstracts)

TANABE, YUICHI, TSUNEO ABE, KENTANO HIMENO, TADATSUNE KANEKO, KAZUSHIGE MOGI, YUICHI SAEKI, and **TATSUO HOSODA.**
THYROTROPHIC HORMONE CONTENT OF THE PITUITARY OF MOLTING AND LAYING HENS. Endocrinol. Japon. 5(2): 118-121. 1958.—Thyrotropic hormone content of the pituitary of molting and laying hens was determined by the increase in epithelial cell height and P^{32} uptake of the thyroids of recipient chicks. By either measurement, thyrotropic hormone content of the pituitary of laying hens was higher than that of the pituitary of molting hens, although no significant difference was observed between the two. Any evidence of the activation of thyroid-pituitary system was not observed in molting period of the hen. (Biological Abstracts)

TAKAHASHI, AISUKE. (Osaka Med. Coll., Japan.)
CHANGES OF SULPHUR-CONTAINING AMINO ACIDS IN HEN-EGGS DURING THEIR HATCHING AND THE EFFECTS OF VITAMIN B_{12} UPON THEM. Bull. Osaka Med. Sch. 2(1): 33-42. 1955. (Biological Abstracts)

WINGET, CHARLES M., and **ARTHUR H. SMITH.** (U. California, Davis.)
CHANGES IN PLASMA CALCIUM CONCENTRATION DURING EGG FORMATION. Poultry Sci. 37(3): 509-512. 1958.—The total calcium in the plasma of a laying hen appears to fluctuate diurnally, depending on shell gland activity. The similarity of calcium concentration changes in hens with active and with inactive oviducts indicates that these changes may not be a direct result of shell mineralization. The decrease in circulating calcium during egg formation occurs mainly in the bound form (nondiffusible). The ionic plasma calcium increases relative to total calcium while the shell gland is actively forming shell mineral. (Biological Abstracts)

NUTRITION

ARSCOTT, G. H., and **LOIS A. SATHER.** (Oregon State Coll., Corvallis.)
PERFORMANCE DATA AND FLAVOR EVALUATION OF BROILERS FED DIETS CONTAINING VARYING AMOUNTS OF ANIMAL FAT. Poultry Sci. 37(4): 844-850. 1958.—Two 9-week trials each involving 6 lots of 250 Red Cornish X New Hampshire broilers fed an all-corn ration containing 0, 3, 6, and 9% fat (prime tallow) or 50% corn and 50% barley with 0 and 6% fat were conducted. A total of 464 pre-selected males were slaughtered and eviscerated by commercial procedure with cooking and flavor evaluation tests performed at 0, 6, and 12 months frozen storage. Results were as follows. A significant improvement in growth was evident from the addition of 3 and 6%

fat to the all-corn ration. With 9% fat, growth was adversely affected. A consistent but non-significant improvement in feed conversion was noted when 3, 6, or 9% fat was added to the all-corn ration. When barley replaced half the corn, feed consumption was markedly increased. A significant improvement in feed conversion and growth was noted when 6% fat was added to the 1:1 corn-barley ration with this treatment comparing favorably to the all-corn control. Adverse feathering was consistently observed when 9% animal fat was used with the all-corn ration. Broilers fed the all-corn ration with 3% fat had significantly less eviscerated loss that reflected in greater oven-ready and cooked weights. While no differences in total percent cooking loss were noted between broilers from the different treatments, broilers fed all-corn with 6% fat showed more drip loss than the all-corn control. No differences in minutes per lb. to cook, in percent dry matter, press fluid and shear force values were noted. No consistent differences could be detected in flavor or juiciness between broilers from the different groups when tested fresh or after 6 and 12 months frozen storage. Although no differences in tenderness were noted between groups on fresh and 6 months storage tests, slight differences in tenderness were indicated at 12 months that were not supported by shear force values. (Biological Abstracts)

BECKER, W. A., and **L. R. BERG,** 1958. [Western Washington Exp. Sta., State Coll. Washington, Puyallup.]

THE SENSITIVITY OF CHICKENS TO DIFFERENCES IN DIET. *Proc. Xth int. Congr. Genet.* [*Montreal*], 1958, Vol. II (Abstr.): 18.—At hatching a total of 263 White Rocks was divided and fed a rapid-growth or a slow-growth diet. It was concluded from the 1-, 4- and 8-wk. body weights that ♂♂ were more sensitive than ♀♀ and that sensitivity was greatest at 4 wks. Weekly weights were taken at 1 to 8 wks. of age in groups of ♂♂ of highly inbred White Leghorn, slightly inbred White Rock, a heterozygous Synthetic breed and Synthetic ♂ × White Rock crossbred stocks. Sensitivity was highest at 2 wks. old, when "White Rocks and White Leghorns were equal in sensitivity followed by the Cross-breds and the Synthetics. All genotypes except the Cross-breds decreased steadily in sensitivity after 2 wks. The Cross-breds increased in sensitivity and were more sensitive than the other genotypes at 7 and 8 wks. of age. Variances on the geometric scale indicated that the inbred White Leghorns were the most variable throughout the experiment. The White Rocks had the least variability at 2 wks. of age while the Cross-breds had the lowest variability at 7 and 8 wks. The main factors that affected sensitivity were the sex and age of a population while variability did not appear to be related to this trait." (Animal Breeding Abstracts)

BROWN, KEITH I. (Ohio Agric. Expt. St., Wooster.)

A PRELIMINARY REPORT ON THE INFLUENCE OF SULFAQUINOXALINE ON ADRENAL PHYSIOLOGY IN THE DOMESTIC FOWL. Poultry Sci. 37(4): 779-781. 1958.—Sulfaquinoxaline (0.0125%) fed continuously in the ration of broiler strain New Hampshire chicks for 8 weeks decreased the amount of glucocorticoids in the birds' adrenals. (Biological Abstracts)

COMBS, G. F., N. V. HELBACKA, and **G. L. ROMOSER.** (U. Maryland, College Park.)

EFFECT OF DIETHYLSTILBESTEROL PELLETING DIETARY FAT LEVEL AND C/P RATIO ON GROWTH, FEED REQUIREMENTS AND QUALITY OF TURKEY FRYERS. Poultry Sci. 37(4): 855-862. 1958.—A study was conducted involving replicated groups of Broad Breasted Bronze turkeys in which the variables of diethylstilbesterol pellet implantation, added fat level, and Calorie-protein ratios were used singly and in combinations during a three-week period (11-14 weeks) to determine their effect on quality and finish as well as rate of gain and feed requirements. Implantation of turkey fryers with 15 mg of diethylstilbesterol in pellet form signifi-

cantly increased the rate of gain and total fat deposition over their respective controls. Quality observations on fryers receiving rations containing 10% added fat did not reveal any significant differences over their respective controls which were fed rations containing 2% added fat, although growth rate was improved and feed requirement was decreased when 10% fat was included in their rations. In comparing turkey fryers receiving rations with C/P ratios of 44:1 or 60:1, no significant differences were noted in rate of gain between 11 to 14 weeks but the degree of finish, as measured by dressed finish score, abdominal fat score and dripping losses from cooking, was significantly better when rations with C/P ratios of 60:1 were used. (Biological Abstracts)

COMBS, G. F., G. L. ROMOSER, and **C. S. SHAFFNER.** (U. Maryland, College Park.)

NYSTATIN (MYCOSTATIN) IN RATIONS FOR GROWING TURKEYS. Poultry Sci. 37(4): 896-898. 1958.—Two experiments, conducted with Maryland Medium White turkeys, failed to show any apparent effect of Nystatin (33 mg/kg) on rate of growth, feed conversion or mortality to 20 weeks of age. These turkeys were reared in confinement with wire floor runs and usual management procedures were followed. No fungal infections were encountered during the study. (Biological Abstracts)

COUCH, J. R. (Texas A. and M. Coll., College Station.)

FEEDS FOR LAYERS. Western Feed and Seed 13(2): 26-27, 74-76. 1958.—An all-mash feed should be used including sufficient calcium, 18% protein balanced in essential amino acids and 1000 calories of energy. Fat, 2.5 to 5.0%, vitamins, minerals, antibiotics, arsonic acid, and unidentified growth factors should also be included in this mash. (Biological Abstracts)

COUCH, J. R. (Texas A. and M. Coll., College Station.)

SELF-RESTRICTING DIET DEVELOPED FOR PULLETS. Western Feed and Seed 13(9): 24, 56, 58. 1958.—A high fiber formula containing 15 to 20% crude fiber and 13% protein holds down calorie intake, delays maturity, lowers body weight, and increases egg size when pullets come into production. (Biological Abstracts)

COWLISHAW, S. J., and **D. E. EYLES.** (Grassland Res. Inst., Hurley, Berkshire, Eng.)

THE USE OF DRIED CLOVER IN THE DIET OF LAYING HENS. Poultry Sci. 37(4): 960-966. 1958.—For 8 weeks from the start of egg laying 9 x 12 pullets in battery cages were fed on diets containing 0.10 or 20% dried clover, 6.8 or 15.4% crude fiber, and 14.5 or 19.6% crude protein. Weight gains were significantly decreased by increasing clover and fiber levels ($P < .001$) and there was a clover X protein interaction ($P < .05$). Egg yields were significantly decreased by increasing clover ($P < .001$) and fiber ($P < .01$) levels. Protein levels had no significant effect on egg yields. Food intake was significantly increased by increasing fiber level ($P < .001$) and was reduced by increasing the level of dried clover in the high fiber diets. As the fiber level increased the energy content decreased and food intake increased to maintain optimum energy intake for egg production. This process was counteracted by increasing clover level, which decreased food density and increased food intake to a maximum, after which production suffered due to insufficient intake of metabolizable energy. (Biological Abstracts)

DAVIS, P. N., and **F. H. KRATZER.** (U. California, Davis.)

THE RELATION OF SERUM XANTHOPHYLL IN CHICKENS TO THE PIGMENTATION OF THEIR SHANKS. Poultry Sci., 37(4): 851-854. 1958.—The level of serum xanthopyll of chicks fed a low pigment ration for one week followed by a test ration for one week was

highly correlated with degree of pigmentation of the shank after 3 or 4 weeks of feeding. The relationship was true not only for materials which contain relatively high levels of xanthophyll such as alfalfa and concentrates of it, but also for annatto, coal tar butter colors, dried carrots, and β-carotene whose pigments are not actively deposited in the shank. (Biological Abstracts)

DAY, ELBERT J., LESTER J. DREESEN, and **JAMES E. HILL.** (Mississippi State U., State College.)

GRIT FOR LAYING HENS. Poultry Sci. 37(4): 829-833. 1958.—The performance of White Leghorn birds was significantly improved by feeding insoluble grit during a 9 months test with both the all-mash and mash-grain (free-choice) systems of feeding. The response to grit was essentially the same for both feeding systems but feed efficiency tended to be better for the birds receiving an all-mash ration than for the birds receiving mash and whole grains, with or without insoluble grit. In a 2nd trial performance of White Leghorn and New Hampshire birds was not significantly affected by supplementary insoluble grit nor the system of feeding. (Biological Abstracts)

DONALDSON, W. E. (U. Rhode Island, Kingston), **G. F. COMBS,** and **G. L. ROMOSER.**

STUDIES ON ENERGY LEVELS IN POULTRY RATIONS 3. EFFECT OF CALORIE-PROTEIN RATIO OF THE RATION ON GROWTH, NUTRIENT UTILIZATION AND BODY COMPOSITION OF POULTS. Poultry Sci. 37(3): 614-619. 1958.—In an experiment with poults reared to 4 weeks of age, growth was reduced as the ratio of productive energy to crude protein was raised above 27.0, 45.5 and 47.2 calories of productive energy per pound for each 1% of crude protein in 3, 10.5 and 18% added corn oil rations, respectively. Feed consumed per g gain increased as the ratio of productive energy to protein was widened within each fat series. Calories consumed per g gain were constant at ratios narrower than 40 calories of productive energy per pound for each 1% crude protein but increased as the ratio was widened beyond 40:1. Less protein was consumed per g gain as the ratio of energy to protein was widened. Increased ratio also resulted in increased carcass fat, decreased carcass protein and unchanged carcass water contents. Increased dietary fat level caused increased fat content and decreased protein and water contents of the carcass. Productive energy to crude protein ratio (below 41:1) appeared to have less effect in altering carcass composition than did fat level. (Biological Abstracts)

DOUGLAS, C. R. (U. Florida, Gainesville), **H. J. HOCHREICH,** and **R. H. HARMS.**

GLYCINE IN BROILER NUTRITION. Poultry Sci. 37(3): 620-624. 1958.—Two nine-week floor studies, involving 3200 broilers, were conducted to study the possibility of glycine being a limiting amino acid in a broiler feed when the principle source of protein was soybean oil meal fortified with fish meal and dried whey. The addition of 0.2% glycine to a basal diet containing added methionine hydroxy analogue (MHA) resulted in significantly improving growth rate of males. When a 21% protein diet was supplemented with glycine and MHA growth rate was obtained which was equal to growth obtained from feeding diets containing 24 or 25% protein without supplemental amino acids. The protein requirement for males in these experiments appeared to be higher than the requirement for females. (Biological Abstracts)

EDWARDS, H. M. Jr., R. J. YOUNG, and **M. B. GILLIS.** (Internatl. Minerals and Chem. Corp., Skokie, Illinois.)

STUDIES ON ZINC IN POULTRY NUTRITION. 1. THE EFFECT OF FEED, WATER AND ENVIRONMENT ON ZINC DEFICIENCY IN CHICKS. Poultry Sci. 37(5): 1094-1099. 1958.—In experiments with chicks reared under various conditions, severe symp-

toms of zinc deficiency could be produced in chicks housed in plastic-stainless steel cages and given glass-distilled water. A variable and a less severe zinc deficiency was obtained with chicks housed in the standard galvanized brooder even though chicks were given glass-distilled water and special precautions were taken regarding the method of feeding and watering. However, a more severe zinc deficiency was obtained when the brooder was coated with an epoxy resin and the chicks were fed and watered from stainless steel troughs. Evidence is presented which shows that the chick's environment and source of water can supply the chick's need for zinc. A zinc deficiency in chicks causes a reduced rate of gain, shortening and thickening of leg bones, an enlarged hock condition, a reduction in bone ash and poor feather development. (Biological Abstracts)

ERIKSSON, STURE.
ENERGY REQUIREMENT FOR MAINTENANCE OF ADULT HENS. K. Lantbrukshogskolans Annaler 21: 385-388. 1954.—For non-laying hens of the Rhode Island Red breed the maintenance requirement for metabolizable energy amounted to 160 kcal per animal daily at 20° C, and a body weight of 2.0 kg. At 15° C the requirement was about 12% higher, but further investigations are needed before any definite conclusions can be drawn. (Biological Abstracts)

EVANS, ROBERT JOHN, SELMA L. BANDEMER, and **J. A. DAVIDSON.**
(Michigan State U., East Lansing.)
VEGETABLE OILS IN RATIONS FOR LAYING HENS. Poultry Sci. 37(4): 977-978. 1958.—Eggs produced by hens fed rations containing 2.5% of crude cottonseed oil developed viscous pink whites and large salmon colored yolks after 6 months or more of cold storage. No discoloration occurred when hens were fed similar levels of crude sesame, safflower, tung, peanut, rice bran, linseed, soybean, or corn oils. (Biological Abstracts)

FANGAUF, R., H. VOGT, and **G. BARLOWEN.** v. Weiterer Versuch uber die Wirkung von Methionin auf das Kukenwachstum bei ublichen Mastfuttermischungen.
FURTHER STUDY ON THE EFFECT OF METHIONINE ON GROWTH OF CHICKENS ON COMMON FATTENING RATIONS. *Arch. Geflügelk.*, 1958, *22*, 145-148. [Lehr- u. Versuchsanst. Kleintierzucht, Kiel-Steenbek.] English summary.—For earlier work see Abst. 3131, Vol. 28.—The effects of adding 0.05 per cent. DL-methionine to standard French, German and American fattening rations were tested over an 8-week period with groups of 35-day-old New Hampshire chicks. Full details of the feeds are given. Feed consumption for the rations without added methionine was 1629, 1752, 1606 g., and for those with methionine 1693, 1755, 1971 g., respectively; intake of total digestible nutrients without methionine was 1120, 1218, 1142 g., and with methionine 1163, 1221. 1402 g.; weight gains were 554, 643, 532 g. and 605, 688. 823 g.; feed used per kg. gain was 2.9, 2.7, 3.0 and 2.8, 2.6, 2.4 kg. The results for feed consumption do not agree with those of previous trials in which added methionine seemed to lower feed consumption, but confirm that addition of DL-methionine to rations with small amounts of fishmeal gives improved growth and feed efficiency. (Nutrition Abstracts and Reviews)

FALIU, L. Notions pratiques sur l'alimentation des volailles en elevage fermier a l'usage des veterinaires praticiens.
FEEDING OF POULTRY ON THE FARM AS RECOMMENDED BY THE PRACTISING VETERINARIAN. *Rev. Méd. vét., Toulouse*, 1958, *109*, 385-398. English and Spanish summaries.—The feed which poultry running free on farms are able to obtain for themselves cannot be estimated accurately; it varies according to season and the degree of freedom allowed. Requirements of growing, fattening and laying poultry, and the composition of common feedingstuffs, are discussed and summarised in tables. As most economical method of feeding is suggested

a mash and grain system, in which protein content of total feed can be adjusted by using one mash mixture with constant protein and varying the ratio of grain to mash. Green feed should always be given, and layers should have additional calcium. (Nutrition Abstracts and Reviews)

FORBES, M., W. C. SUPPLEE, and G. F. COMBS. (U. Maryland, College Park.)

RESPONSE OF GERM-FREE CONVENTIONALLY REARED TURKEY POULTS TO DIETARY SUPPLEMENTATION WITH PENICILLIN AND OLEANDOMYCIN. Proc. Soc. Exptl. Biol. and Med. 99(1): 110-113. 1958.—Maryland Medium White and Beltsville White poults reared under germ-free conditions showed excellent growth on a purified type washed Drackett protein starch basal diet. Supplementation of the diet with procaine penicillin (45 mg/kg) or with oleandomycin (30 mg/kg) did not improve growth. In concurrent tests, conventionally reared poults fed the basal ration grew at a lower rate than germ-free birds while those fed the basal ration supplemented by either penicillin or oleandomycin grew at a rate comparable to that of germ-free birds. Results of these experiments are in agreement with the theory that growth response to antibiotics is due to their action on the microflora. (Biological Abstracts)

FRENCH, M. H., and MARGARET A. LEDGER. (East African Vet. Res. Organization, Muguga, Kenya.

THE RATE OF GROWTH AND THE EFFICIENCY OF FOOD CONVERSION IN VARIOUS BREEDS OF POULTRY. East African Agric. Jour. 22(2): 60-63. 1956.—Breeds of poultry, imported as day olds can grow at Muguga (6800 feet) at rates which differ very little from those secured in temperate zones. The efficiency of food conversion for such birds is also little different from those reported from the temperate latitudes. The amount of food consumed per lb. of live-weight increase rises sharply from 14-16 weeks of age for the North Holland Blue, Brown Leghorn and Cambar and Welsummer breeds. For Aylesbury ducklings and Roman geese a decreased gross efficiency of food conversion commences at an earlier age than with chickens and suggests that ducklings should be sold when not older than 14 weeks and that well fed goslings are better sold when 12-13 weeks old. (Biological Abstracts)

FULLER, HENRY L. (U. Georgia, Athens.)

THE VALUE OF GRANITE AND MARBLE GRIT FOR GROWING CHICKENS AND LAYING HENS FED ALL-MASH VS. MASH AND GRAIN DIET. Poultry Sci. 37(5): 1136-1143. 1958.—A comparison of granite grit, crushed marble grit and no grit in feeding programs involving all-mash vs. mash and grain was made during the starting, growing, and laying period of White Leghorn pullets. The presence or kind of grit had no significant effect on growth rate during the starting and growing periods, nor upon the later response of birds to grit during the laying period. Where mash and whole grain was fed egg production and egg size were greatest where the birds also received granite grit and oyster shells and least where crushed marble only was supplied as a source of grit and calcium. In the all-mash series, presence or kind of grit was without significant effect on egg production. Egg shell thickness and texture were not affected by grit treatment or method of feeding. Consumption of grit and oyster shell was slightly greater with the all-mash than with the mash and grain feeding program; whereas, egg production was significantly poorer in the all-mash series. (Biological Abstracts)

GLEDHILL, ROBERT HAMOR. (Purdue U., Lafayette, Indiana.)

EFFECT OF ANTIBIOTICS ON GROWTH AND EGG PRODUCTION OF CHICKENS. Dissertation Absts. 18(1): 13. 1958. (Biological Abstracts)

GRAU, C. R. (U. California, Davis.)
NOW, COTTONSEED FOR LAYERS. Western Feed and Seed 13(2): 25. 1958.—Cottonseed meals containing not more than 0.3 available gossypol units (AGU) can be fed with safety as 10% of the total diet of laying hens. Yolks with high gossypol develop brown or olive discolorations in storage. (Biological Abstracts)

GRAY, JEAN A., D. C. HILL, and **H D. BRANION.** (Ontario Agric. Coll., Guelph, Canada.)
EFFECT OF AUTOCLAVING ON THE NUTRITIVE VALUE OF ARGENTINE RAPESEED FOR CHICKS. Poultry Sci. 37(3): 734-736. 1958.—Autoclaving ground Argentine rapeseed at 15 lb. pressure for period of 10 minutes, 20 minutes, 1 hour, 2 hours, or 3 hours improved its ability to support growth of chicks. Maximum beneficial effect from autoclaving was obtained in a 10 minute period with little or no loss of lysine. When the period of autoclaving was increased to 1 hour or more the improvement over the raw seed was less but still substantial, provided supplemental lysine was added to replace that destroyed by the heat treatment. (Biological Abstracts)

HEYWANG, BURT W. (U.S. Dept. Agric., Glendale, Ariz.), **F. X. GASSNER,** and **C. R. THOMPSON.**
EFFECT OF FEEDING 2,5 DI-TERT-BUTYL-HYDROQUINONE AND 2,5 DI-TERT-AMYL-HYDROQUINONE TO CHICKENS. Poultry Sci. 37(4): 839-844. 1958.—The butyl derivative caused initial acute toxic symptoms in eight-week-old chickens when given as a drench at levels of 2-10 g/kg body weight. Chronic toxicity studies showed this compound, when fed at 0.250% of the diet, to be much more toxic than the corresponding amyl derivative, especially to young chicks. Chronic toxicity symptoms were violent trembling, reduction in growth, some mortality, reduced egg production, and impaired hatchability. Feeding 0.250% of the amyl derivative for an extended period gave a slight growth depression but no other effects were detected. With 0.025 and 0.075% of the amyl compound no deleterious symptoms were observed. (Biological Abstracts)

HINNERS, SCOTT WILLIAM. (U. Illinois, Urbana.)
A BIOASSAY FOR DETERMINING THE NUTRITIONAL ADEQUACY OF PROTEIN SUPPLEMENTS FOR CHICK GROWTH. Dissertation Absts. 18(5): 1567. 1958. (Biological Abstracts)

HOCHREICH, H. J. (U. Arizona, Tucson), **C. R. DOUGLAS, I. H. KIDD,** and **R. H. HARMS.**
THE EFFECT OF DIETARY PROTEIN AND ENERGY LEVELS UPON PRODUCTION OF SINGLE COMB WHITE LEGHORN HENS. Poultry Sci. 37(4): 949-953. 1958.—Results of a ten-month laying experiment, involving 624 Single Comb White Leghorn hens, indicated that a minimum level of 17% protein in the feed was required to maintain maximum egg production. These experimental feeds contained a minimum of 941 calories of productive energy per pound of feed and the hens maintained an average egg production rate of approximately 70% for the experimental period. Feed efficiency was significantly improved by the addition of 6.6 stabilized yellow grease to diets containing 15.7, 17.0 or 18.35% protein with approximately 950 calories of productive energy per pound of feed, however, this addition had no effect on rate of egg production. Addition of the stabilized yellow grease to the feed increased egg weights, and decreased egg shell thickness. Neither level of protein in the diet nor addition of stabilized yellow grease significantly affected fertility and hatchability of eggs or mortality and body weight of hens. (Biological Abstracts)

HOHLS, H. W. Produktive Kalorien oder verdaulicher Gesamtnahrstoff?
PRODUCTIVE CALORIES OR TOTAL DIGESTIBLE NUTRIENTS? *Deutsch. Wirtschaftsgeflügelzucht*, 1958, *10*, 483-484; 486. [Bundesforschungsanst. Kleintierzucht, Celle.] — The nature of the American concept of "productive" energy is discussed. It is taken as synonymous with net energy. For fully grown birds that may be so, but it does not hold for growing chicks. In the growing bird energy lost as heat increases in direct linear relation to the amount of protein deposited; net energy is correspondingly less. The same tendency exists with TDN and productive energy but, in the same experiment, differences between computed productive energy and measured net energy may vary between 5 and 30 per cent., with net energy always less. TDN and productive energy are closely related. (Nutrition Abstracts and Reviews)

HOHLS, H. W. Der Bewertungsmassstab bei Mastprufungen an wachsendem Geflugel.
THE EVALUATION CRITERION IN FATTENING TRIALS WITH GROWING POULTRY. Ztschr. Tierphysiol. Tierernährung *Futtermittelk.*, 1958, *13*, 212-230. [Bundeesforschungsanst. Kleintierzucht, Celle.] English summary.—If any bonus for quality is neglected, the average net profit from fattening chickens depends on the quantity of feed over and above that for maintenance, the heat increment of feeding, the biological value of the dietary protein or the maximum protein deposition (see Abst. 4413, Vol. 25), and the percentages of digestible protein, carbohydrate and fat in the diet.

The heat increment of feeding is got from respiratory experiments (see Abst. 676, Vol. 29), from which also the amounts of protein and fat deposited can be calculated. An experiment with 26 groups each of 20 Leghorn chicks reared in batteries to 8 weeks on diets differing in crude protein content, ratio of protein to total nutrients, naure of protein, fat content, and crude fibre content showed that at metabolisable energy values above 4500 Cal. per kg. the heat increment of feeding, contrary to Kellner's finding with full-grown oxen, was no longer proportional to metabolisable energy. As has been shown already, the heat increment of feeding was proportional to the protein deposited, 1 g. protein corresponding to 7.8 Cal.; it bore no relation to the fat deposited, nor was there any connection between the protein and the fat deposited. The maximum daily protein deposit was concluded to be 2 g. on the average.

These general principles are applied to the study of a feed with 16 per cent. digestible crude protein of biological value 60 per cent., and N-free constituents with metabolisable energy 2.0 Cal. per g. A series of tables give the daily weight gains for amounts of feed for production ranging from 10 to 40 g. and the average net profit for different amounts of feed for production, maximum protein deposition of 1·5 or 2·0 g. daily, and heat increment of feeding 5·0 or 7·8 Cal. per g. The former heat increment was the more profitable. Further comparisons bring out the importance of the maximum protein deposition and show that the crude feed efficiency (g. feed per g. weight gain) is not generally a measure of fattening capacity. Similar considerations apply to fattening to a given weight instead of for a given time; for scientific evaluation the former seems preferable. Further experiments are planned to find whether the maximum protein deposition depends on the crude protein content of the diet. (Nutrition Abstracts and Reviews)

JACKSON, N., and **W. O. BROWN.** (Queen's U., Belfast, Ireland.)
THE EFFECT OF GONADAL HORMONES ON NITROGEN RETENTION IN THE IMMATURE FOWL. Poultry Sci. 37(4): 886-889. 1958—The effect of treatment of immature female fowl with an estrogen and an estrogen plus androgen on N retention, growth of the oviduct and on blood composition was studied. The combined hormone treatment resulted in a significant increase in N retention over that in controls and in birds receiving estrogen only. The relation of this finding to the rapid growth of the oviduct associated with the onset of ovarian activity in the fowl is discussed—W.O. Brown (Biological Abstracts)

JAFFE, W. P. (Bristol U., Eng.), and **J. A. WAKELAM.** (Distillers Co. Limited, London.)
GROWTH PROMOTING FACTORS IN MALT DISTILLERS DRIED SOLUBLES. I. THE EFFECT OF THE MINERAL COMPONENTS. Poultry Sci. 37(3): 520-529. 1958.—During the investigation of the growth promoting properties of malt distillers dried solubles for chicks, it was found that raising the level of Mn in the basal diet from 54 per lb. to 185 per lb. eliminated any response to the ash of such solubles. Other work reported here and elsewhere has shown consistent responses in terms of both live weight increase and food conversion efficiency when malt distillers dried solubles were added at levels of the order of 3% to a diet fully supplemented with all known nutrients and with penicillin. The basal diet provided high levels of protein (casein and gelatin) and of energy (starch, sucrose and lard) and levels of all known vitamins were added which were well in excess of normal recommendations. A high level of growth (over 400 g at 4 weeks) was supported by the basal (control) diet but the further growth responses to solubles reached a high degree of statistical significance. The authors do not suggest that Mn in the ash of the solubles is directly responsible for its growth promoting properties with low levels of Mn in the control diet, although at 1st sight the relatively high Mn content of the ash seems to suggest this. It seems more likely that some complex interaction is involved.—Authors. (Biological Abstracts)

KALINIA, M. I. Malokoncentratnoe kormlenie kur.
FEEDING POULTRY WITH SMALL AMOUNTS OF CONCENTRATES. *Zivotnovodstvo*, 1958, No. 4, 54-57. [Vet. Akad., Moscow.] In the first experiment a control group of 698 and an experimental group of 654 Russian White pullets all received, in g. per head daily, fishmeal 4, meat-and-bone meal 2, groundnut cake 2, casein 3, yeast hydrolysate 3, baker's yeast 4, shell grit 6, bonemeal 2, whey 10, cod liver oil 1, haymeal 2, vitamin paste 3, dried nettles 3, curds 4, yeast liquor 10 and salt 0·3. The control group received on the average mixed cereals 115 and potatoes 5 g. per head daily and the experimental group cereals 57·5 and potatoes 100 g. The two rations supplied 94·94 and 74·91 g. digestible dry matter and 19·64 and 15·99 g. digestible protein.

In 5 months the mean number of eggs laid were 83·1 and 85·9. Chicks from eggs laid by the experimental group were divided into 2 further experimental groups, those from the control group were again a single control group. The chicks were reared on a control ration predominantly of concentrates or on experimental rations with a large amount of potatoes or of carrots and turnips; by the age of 125 days the experimental groups were receiving potatoes 100 or roots 80 g. daily. In the first laying season mean numbers of eggs were in the control group 168·1, in those given potatoes 174·3 and in those given roots 170·2. The eggs of both experimental groups contained more carotene than those of control pullets.

A total of 55,800 eggs from the two generations were incubated. Hatchability of eggs of the first generation was 84.5 per cent. in the experimental and 81.9 in the control group, infertile eggs were 9.2 and 11.5 per cent.; in the second generation the group given potatoes gave 87.8, the group given roots 86.1 and the control group 83.6 per cent. healthy chicks.—(Nutrition Abstracts and Reviews)

KLAIN, G. J., H. M. SCOTT, and **B. CONNOR JOHNSON.** (U. Illinois, Urbana.)
THE AMINO ACID REQUIREMENT OF THE GROWING CHICK FED CRYSTALLINE AMINO ACIDS. Poultry Sci. 37(4): 976-977. 1958.—A free amino acid diet has been developed which, when fed ad libitum, is consumed in sufficient amounts to support satisfactory growth (9-11g/chick/day.) It has been used in determining the requirement of the growing chick for each of the essential amino acids.—G. J. Klain. (Biological Abstracts)

KODINEC, G. A. Vlijanie ekstrakta cajnogo griba na rost i razvitie cypljat. EFFECT OF THE TEA FUNGUS EXTRACT ON GROWTH AND DEVELOPMENT OF CHICKENS. *Antibiotiki*, 1958, *3*, No. 2, 99-102. [Herson. Sel'skohoz. Inst. im. A.D. Cjurupy.]

For 90 days 2 groups of day-old chicks were given a normal chick ration, and in addition the experimental group got tea fungus, *Medusomyces gisevii*, extract, 3 g. per kg. feed. Compared with the controls, weight of the experimental animals increased by 27.2 per cent., loss from disease was halved and feathering was improved, particularly at 20 days of age. (Nutrition Abstracts and Reviews)

KOKATNUR M., N. T. RAND, and F. A. KUMMEROW. EFFECT OF THE ENERGY TO PROTEIN RATIO ON SERUM AND CARCASS CHOLESTEROL LEVELS IN CHICKS. Circulation Res. 6(4): 422-431. 1958.—Twenty-four groups of chicks were kept in three replicates of 10 birds each on two nutritionally complete basal diets. Both of these diets furnished all of the known amino acid, vitamin and mineral requirements but varied in total carbohydrate, fat and protein content. The fat and protein levels of these diets were adjusted by the addition of beef tallow or corn oil and soybean protein, methionine and glycine or casein at the expense of glucose. The experiments were terminated at the end of 4 weeks, five ml of blood were drawn from the two median chicks in each replicate and the six weighed individual carcasses digested with hydrochloric acid. The fat was removed from this digest by extraction with solvent and its cholesterol value determined. The results indicated that the energy to protein, or E/P, ratio had a significant effect on serum cholesterol levels. An analysis of variance showed that at low or moderate levels of corn oil statistically significant lower serum and carcass cholesterol levels were noted at an E/P ratio of 11.5 as compared to a ratio of 22.6. When the energy supplied by dietary corn oil was increased from 1.3 to 57.1%, the serum cholesterol value decreased from 200 to 136 mg% at an E/P ratio of 22.6 and from 166 to 129 mg% at an E/P ratio of 115. It was interesting to note that almost twice as much total carcass fat was found at an E/P ratio of 22.6 than at an E/P ratio of 11.5 or approximately 9 and 5% respectively. Variations in dietary fat or dietary protein did not alter the percentage of total carcass fat significantly as long as the E/P ratio remained constant. The influence of the E/P ratio on serum and carcass cholesterol levels was independent of the type of dietary fat. A "hard" fat such as beef tallow gave results similar to a "soft" fat such as corn oil.—Authors. (Biological Abstracts)

KRATZER, F. H., PRAN VOHRA, P. N. DAVIS, and R. L. ATKINSON. (U. California, Davis.) FAILURE TO OBTAIN GROWTH RESPONSES IN POULTS WITH OROTIC ACID, LIPOIC ACID, MEVALONIC ACID AND GIBBERELLIC ACID. Poultry Sci. 37(4): 955-960. 1958.—Dried whey was fractionated and the fraction containing orotic acid was inactive for promoting growth of poults fed a purified, Drackett protein, basal ration. Orotic, lipoic, mevalonic and gibberellic acids gave very slight or no growth response for poults when added basal rations singly or in combination. A methanol soluble and acetone insoluble fraction of soybean oil meal was highly growth-promoting.—P. Vohra. (Biological Abstracts)

KRAUTMANN, B. A., S. M. HAUGE, E. T. MERTZ, and C. W. CARRICK. (Purdue U. Agric. Expt. Sta., Lafayette, Indiana.) SOURCES OF THE FACTOR WHICH LOWERS THE ARGININE LEVEL IN A CASEIN DIET. Poultry Sci. 37(3): 530-534. 1958.—These experiments were conducted with Barred Plymouth Rock and White Cross male chicks from 1 to 4 weeks of age. When corn replaced glucose as the carbohydrate source in a casein diet containing about 0.8% arginine, marked growth responses were obtained at comparable arginine levels. Substitution of 4.7% soybean oil meal for casein, on an

arginine equivalent basis, resulted in marked growth response. Grass juice concentrate, corn steep liquor or corn starch were ineffective. Corn germ and corn bran were more effective than the endosperm. Growth responses produced by corn and soybean meal are interpreted to be vitamin-like, rather than protein or amino acid responses, because small changes in amino acid levels do not produce gains of the magnitude obtained.—Authors. (Biological Abstracts)

KRAUTMANN, B. A., S. M. HAUGE, E. T. MERTZ, and **C. W. CARRICK.** (Purdue U. Agric. Expt. Sta., Lafavette, Indiana.)

PHENYLALANINE AND THREONINE LEVELS FOR YOUNG CHICKS. Poultry Sci. 37(3): 535-538. 1958.—These experiments were conducted with Barred Plymouth Rock male chicks from 1 to 4 weeks of age. Under the conditions of these experiments the aromatic amino acid requirement was satisfied at 1.18% of the diet, both with or without corn, when isolated soybean protein and gelatin were used as primary sources of protein. The minimum L-threonine requirement was between 0.55 and 0.60% in a 21% protein diet. These results indicate that it is unlikely that deficiencies of aromatic amino acids, phenylalanine and tyrosine, or threonine will be a problem in the formulation of practical rations for young chicks.—Authors. (Biological Abstracts)

LACASSAANE, L. (Sta. Rech. avicole, Jouy-en-Josas, France.) Influence de l'ingestion de proteines iodees sur les reserves vitellines de l'ovocyte chez la poule domestique.

INFLUENCE OF THE INGESTION OF IODINIZED PROTEIN ON THE VITELLINE RESERVE OF THE OOCYTE IN THE DOMESTIC HEN. Ann. Inst. Natl. Rech. Agron. Ser. D. Ann. Zootech. 6(3): 283-290. 1957.—Iodinized protein containing 1.3% DL thyroxine at a dosage of 0.044% of the ration was fed to hens 10 months of age. Results obtained during the first 3 weeks were compared to a similar base period of 3 weeks for both controls and treated birds. Treatment caused an inhibition of weight increase of the ovules normally expected during this period and a significant reduction in the average weight of ovules with reference to the last days of the base period.—J. S. Greenstein. (Biological Abstracts)

LIEBSCHER, W. Die Fruhsterblichkeit der Kuken.

EARLY MORTALITY OF CHICKS. *Deutsch. Wirtschaftsgeflugelzucht*, 1958. *10*, 568-569; 589-590.

In trials with newly hatched chickens from 3 poultry farms 5 B vitamins added to drinking water reduced losses significantly in 3 trials but had little or no effect in 3 where losses were already low, and in one there were more losses, which were believed to be due to causes other than vitamin B deficiency.

Some literature on the vitamin requirements of chickens is reviewed and it is concluded that a good store of vitamins in the chick at the time of hatching is decisive for healthy development. (Nutrition Abstracts and Reviews)

McGINNIS, JAMES, LOUIS H. MERRILL (State Coll. Washington, Pullman), **RAMON E. FRY,** and **LEO S. JENSEN.**

USE-HISTORY OF ANTIBIOTICS AS RELATED TO THEIR EFFICACY IN PROMOTING GROWTH OF TURKEYS. Poultry Sci. 37(4): 810-813. 1958.—Comparison was made of the use of "old" antibiotics normally used in animal feed and 2 "new" antibiotics not used in animal feeds for turkey poults growth. Only slight improvement in growth was obtained with turkeys by supplementing a practical diet with procaine penicillin, Terramycin or streptomycin. Significant growth responses were obtained by supplementing the diet with the "new" antibiotics, oleandomycin phosphate or erthromycin thiocyanate. Results suggest a need to re-evaluate the effectiveness of specific antibiotics for stimulating animal growth. (Biological Abstracts)

McDONALD, M. W. (Dept. Agric., Seven Hills, New South Wales).
METHIONINE SUPPLEMENTS IN CHICKEN DIETS. IV. THE EFFECT OF DL-METHIONINE SUPPLEMENTATION OVER FULL AND PART OF GROWING PERIOD ON GROWTH AND EFFICIENCY OF COCKERELS FROM THE RECIPROCAL CROSSES OF WHITE LEGHORNS AND AUSTRALORPS. Australian Jour. Agric. Res. 9(5): 708-716. 1958.—The commercial value of DL-methionine supplementation of diets based on wheat products and meat-meal has been investigated. The effects of 0.025, 0.05, and 0.02 per cent. methionine on growth and feed efficiency were studied on White Leghorn chickens up to 6 weeks of age. It was concluded that maximum dose response occurred between 0.05 and 0.20 per cent. supplement. Under simulated commercial conditions, comparisons were made between WL X AO and AO X WL cockerels fed high and low energy diets unsupplemented or supplemented with 0.1 per cent. methionine to 8 weeks of age, or 0.1 per cent. methionine to 12 weeks of age. Neither methionine supplement produced a significant improvement in body weight when the low energy diet was fed. Both methionine supplements produced significant improvements in weight when the high energy diet was fed. In both diets methionine continuously produced highly significant improvements in feed efficiency, while methionine only to 8 weeks produced a significant improvement in efficiency only in the high energy diet. There was no difference between reciprocal crosses in weight or feed efficiency. (Biological Abstracts)

MAEDA, N'KELLA. (Dept. Vet. Serv., Tanganyika, Africa.)
ANTIBIOTICS AS DIETARY SUPPLEMENTS FOR POULTRY. East African Agric. Jour. 23(4): 273-274. 1958. (Biological Abstracts)

NARAIN, RAM, CARL M. LYMAN, and J. R. COUCH. (Texas Agric. Expt. Sta., College Station.)
EFFECT OF INCREASED PROTEIN LEVEL IN THE HEN DIET ON THE TRANSFER OF GOSSYPOL-CEPHALIN TO THE EGG. Poultry Sci. 37(4): 893-896. 1958.—A study was carried out to determine the effects of increased protein levels in the diets of White Leghorn hens on transfer of gossypol-cephalin to the egg. Protein level of these diets was increased from 17.5% up to 35% in the 1st study with the use of fish meal, and in the 2nd experiment through incorporation of soybean oil meal into the diet. Free gossypol was incorporated in the diets at levels of 0.0025% up to 0.01%. The addition of free gossypol to the diet of the hen at these levels produced a progressive increase in the gossypol-cephalin content of egg yolks. A marked reduction in gossypol-cephalin level was obtained with increased protein level in the diet using fish meal. At the same gossypol level (0.0025%) the 35% protein diet produced the gossypol-cephalin reading of 0.025 as compared to 0.034 on the 17.5% protein diet. In the 2nd experiment in which soybean oil meal was used to raise the protein level, no difference was found in amounts of gossypol-cephalin between the groups fed the 2 different protein levels at the same level of gossypol. (Biological Abstracts)

NEWMAN, S., P. J. SCHAIBLE, and L. E. DAWSON.
EFFECT OF SPICES IN FEED ON POULTRY MEAT FLAVOR. *Quart. Bull. Michigan Agric. Exp. Stat.*, 1958, *40*, 747-753.—Broilers raised on the same basal ration were given supplements of garlic powder, celery seed, allspice, sage, clove or monosodium glutamate. In the first trial large amounts were given, 1 lb. per 5 lb. feed for 4 days, and discontinued one day before killing. In the next 2, smaller amounts were given for 13 days, with dienoestrol diacetate included in the ration in the last trial. The supplements, especially in large amounts, reduced feed intake. Garlic impaired the flavour of the cooked flesh, and monosodium glutamate slightly improved it, as compared with the flesh of birds on a normal ration. The other spices did not significantly affect flavour. Garlic flavour of meat was somewhat reduced when dienoestrol was included in the diet. (Nutrition Abstracts and Reviews)

OTSUKA, J. and **T. NAKAJIMA.**
EFFECT OF ^{90}SR ON THE DEVELOPMENT OF THE CHICK EMBRYO. *Bull. Nat. Inst. Agric. Sci., Japan (Ser. G)*, 1958, No. 14, 93-101. In Japanese: English summary.—Chick embryos injected with 500 μC. ^{90}Sr 4 days after incubation died within 10 days. When 100 μC. was injected embryos survived 19 or 21 days and with 1 or 10 μC. hatching was normal. Large amounts of ^{90}Sr were found in bone and liver and haemopoietic function was seriously disturbed. (Nutrition Abstracts and Reviews)

OTT, W. H. (Merck Inst. Therapeutic Res., Rahway, New Jersey.), **W. R. COBB,** and **A. C. CUCKIER.**
FURTHER STUDIES ON THE EFFECT OF NICARBAZIN ON THE GROWTH AND FEED EFFICIENCY OF BROILER CHICKS. Poultry Sci. 37(4): 909-913. 1958.—The effect of 0.005 to 0.0125% nicarbazin on the growth and feed efficiency of 34,400 broiler chickens in floor pens of 150 or 800 birds per pen was determined with 6 commercial rations. Although there was little, if any, clinical coccidiosis, immunity to coccidiosis was demonstrated in all groups and in general growth was improved with all concentrations of nicarbazin. In 2 of the rations feed efficiency was better in nicarbazin-fed groups than in controls. However, in the overall comparison, there was a progressive decrease in feed efficiency with increase in concentration of nicarbazin. This decrease was so small that extensive replications were required to detect it. (Biological Abstracts)

PAYNE, LOYAL F., and **GAYNER R. McDANIEL.** (Kansas State Coll., Manhattan.)
SHELL THICKNESS AS RELATED TO "SHUCK-OUTS" IN TURKEY EGGS. Poultry Sci. 37(4): 825-828. 1958.—The specific gravity of turkey eggs was determined daily during a hatching season of 10 weeks. A record was kept of each egg during the incubation period and the number of "shuck-outs" 28 days after the eggs were set was recorded. The bulk of the eggs (93.4%) ranged in specific gravity from 1.075 to 1.085. From these results, eggs with higher specific gravity had significantly fewer shuck-outs than those with medium to lower specific gravity. As the hatching season advanced specific gravity declined and percentage of shuck-outs increased. (Biological Abstracts)

PETER, V. Vplyv pridavku lucernovej silaze na produkciu a zdravotny stav sliepok.
THE EFFECT OF LUCERNE SILAGE ON THE PRODUCTION AND HEALTH OF HENS. *Polnohospodarstvo*, 1957, 4, No. 6, 1110-1133. [Res. Inst. Animal Prod. SAV, Viglas, Czechoslovakia.] German and Russian summaries.—Average annual egg production of an experimental group of 50 White Leghorn hens given 25 to 100 g. lucerne silage daily was 176.8 eggs compared with 164.2 eggs in a group not given the silage. The difference was not significant. Between November and May hens in both groups laid similar numbers of eggs, 96.7 and 96.4. Average egg weight during the whole year was also similar, 57.76 and 58.35 g. Hatchability in the experimental group was 79.57 and in the control group 64.28 per cent. Feed consumption during the experimental period was 61.637 and 59.250 kg. per hen and 348.58 and 360.75 g. per egg, respectively. Lucerne silage was a satisfactory source of carotene. (Nutrition Abstracts and Reviews)

PETERSON, C. F., E. A. SAUTER, D. H. CONRAD, and **G. J. ANDERSON.** (U. Idaho, Moscow.)
THE INFLUENCE OF PENICILLIN IN THE DIET OF WHITE LEGHORN HENS UPON PRODUCTION AND SHELL QUALITY OF EGGS. Poultry Sci. 37(4): 796-801. 1958.—A study of 43 weeks' duration was made to determine the value of 3 levels (4-20-100 g. per

ton of feed) of penicillin in the diet of White Leghorn pullets in their 1st year of egg production. The major objective, in addition to various production factors, was to determine the influence of the antibiotic upon shell quality as determined by specific gravity technique. Additional stress upon shell quality was obtained by maintaining the environmental temperature of the laying house from the 9th to 43rd week from 75 to 80°F. Penicillin was not effective in preventing the decrease in shell quality which resulted from the temperature increase or which results from increasing age of birds during the production year. Blood calcium levels were not improved by the antibiotic treatments. Similar results were obtained with egg production, egg size, and feed efficiency. Body weight gains were significantly increased by all levels of penicillin treatment. (Biological Abstracts)

PILLA, A. M. Il manganese in rapporto all'indice di accrescimento dei polli.

MANGANESE IN RELATION TO THE GROWTH INDEX OF CHICKENS. *Ann. Sper. agar.*, 1958, *12*, 747-756. [Staz. Sper. Pollicolt., Rovigo.] English summary.—A basal ration with 13 p.p.m. Mn was given to a control group of 66 White Leghorn, New Hampshire and Rhode Island Red chickens of both sexes from day-old to 60 days. Similar experimental groups were given supplements of $KMnO_4$ raising the Mn content of the ration to 35 and 80 p.p.m. Signs of perosis developed only in the group getting 13 p.p.m. Mn. In White Leghorns and New Hampshires, and in all breeds combined, but not in Rhode Island Reds, there was a significant positive correlation between rate of growth and incidence of perosis. In the experimental groups growth was not as good on 35 as on 80 p.p.m. Mn. Efficiency of feed utilisation for growth was similar in all groups. The response to Mn was greater in males than in females, and among breeds was greatest in New Hampshires and least in White Leghorns. There was no significant difference among groups in the ash content of the bones. A ration with 200 p.p.m. Mn, given for 40 days to chickens which had developed perosis, did not cure the disorder. (Nutrition Abstracts and Reviews)

POLIN, D., W. H. OTT (Merck Inst. Therapeutic Res., Rahway, New Jersey.), and **A. ZEISSIG.**

FIELD STUDIES ON THE EFFECT OF NICARBAZIN ON EGG QUALITY. Poultry Sci. 37(4): 898-909. 1958.—Nicarbazin fed to White Plymouth Rock and White Leghorn hens caused a decrease in egg size by reducing yolk size. This occurred at levels of 0.007% and higher. Yolk mottling was significantly increased above the normal incidence in eggs stored 7-10 days but only from hens fed at least 0.005% nicarbazin. There was no direct effect on albumen quality at the highest level fed, 0.010%, but albumen quality was lower in stored eggs with extremely mottled yolks. All effects on egg quality were reversible within 10 days after withdrawal of the drug. Analysis of the yolk mottling data revealed that there was no significant breed difference in response to nicarbazin feeding. The data suggest that the active moiety of nicarbazin, 4,4'-dinitrocarbanilide, may influence the permeability of yolk membrane and that it is the net passage of water from albumen to yolk that causes the decrease in albumen quality associated with extreme mottling. (Biological Abstracts)

POPE, C. W. and **P. J. SCHAIBLE.**

INTERRELATIONSHIPS OF FURAZOLIDONE AND OTHER FEED ADDITIVES ON THE GROWTH OF POULTRY. *Quart. Bull. Michigan Agric. Exp. Stat.*, 1958, *40*, 857-860.—There was no consistent improvement of growth of broiler chicks reared on clean shavings in closed pens, when small amounts of furazolidone, penicillin or arsanilic acid were added to the ration. Significant growth responses were obtained when furazolidone was combined with penicillin or penicillin and 3-nitro-4-hydroxyphenylarsonic acid. A highly significant increase of growth in both sexes was obtained with phenylarsonic acid, and in

females only with a combination of furazolidone, penicillin and phenylarsonic acid. A combination of arsanilic acid and penicillin, with or without furazolidone, increased growth only in males. On the experimental rations, efficiency of feed utilisation was, in general, slightly though not significantly better than on the control ration. (Nutrition Abstracts and Reviews)

PREMACHANDRA, B. N., G. W. PIPES, and C. W. TURNER, (U. Missouri, Columbia.)

THYROXINE SECRETION RATES OF TWO STRAINS OF NEW HAMPSHIRE CHICKENS SELECTED FOR HIGH AND LOW RESPONSE TO THIOURACIL. Poultry Sci. 37(2): 399-404. 1958.—Two lines of New Hampshire fowls, selected for 3 generations on the basis of their response to the feeding of thiouracil by variation in average thyroid weight, were studied, using various indices of thyroid function. The average percentage uptake of I^{131} by the two lines of birds after 24 to 48 hours, was similar. The average rate of release of thyroidal-I^{131} of the two lines was similar although the males in each line showed lower release rates than the females. When the recycling of I^{131} from the metabolism of thyroxin was prevented by feeding thiouracil, the apparent release rates of thyroidal-I^{131} were increased. However, when the thyroxin secretion rate was determined in the two lines of birds, it was observed that the line showing a marked response to thiouracil (highline) secreted an average of 1.02 μg/100 g body weight of l-thyroxine, whereas the low line secreted an average of 2.98 μg/100 g body weight per day. While there was some over-lap of thyroxine secretion rate in the two lines, the degree of separation is quite remarkable. (Biological Abstracts)

RAKO, A., M. FINDRIK, and F. DUMANOVSKY. O potrebi dodavanja mikroelemenata hrani pilica.

NECESSITY FOR ADDING TRACE ELEMENTS TO POULTRY RATIONS. *Vet. Arhiv.* 1958, *28*, 111-116. [Zavod Stocarstvo, Vet. Fak., Sveuciliste Zagreb.] French and English summaries.—Day-old Rhode Island chicks were reared on a basal ration of, per cent., maizemeal 43.5, sunflower cake 5, oatmeal 5, dried yeast 2, lucerne meal 3, soya cake 20, barley meal 10, fishmeal 10, udder meal 1 and iodised salt 0.5. Five groups received the basal ration alone, or with 3 per cent. Vitosan, or with Vitosan and 0.5 per cent. Promix, or with Vitosan and a mixture of trace elements, or with all 3 supplements. Promix supplied in 1 kg. 0.5 g. procaine penicillin; Vitosan contained in 100 g. vitamin A 11,500, vitamin D_3 3500 I.U., and vitamin B_1 1.7, riboflavin 0.9, nicotinic acid 9, panthothenic acid 2, and α-tocopherol 5 mg.; the trace element mixture was per 100 kg. ration Mg 49, Mn 4.5, Fe 2 g., Cu 200 and Co 105 mg. The chicks were kept on wire floors and the study lasted 40 days.

Mean daily weight gains of the groups in the above order were 6.2, 6.6, 6.5, 7.5 and 7.2 g., and feed used per kg. weight gain was 3.1, 2.9, 2.9, 2.8 and 2.7 kg. As the basal ration contained ample amounts of Mg, Fe and Cu, but was low in Mn, it is thought that Mn was mainly responsible for the effect of the trace element mixture. (Nutrition Abstracts and Reviews)

RAND, N. T., H. M. SCOTT, and **F. A. KUMMEROW.** (U. Illinois, Urbana.)

DIETARY FAT IN THE NUTRITION OF THE GROWING CHICK. Poultry Sci. 37(5): 1075-1085. 1958.—The effects of fat on growth, nutrient utilization, protein retention and carcass composition were investigated with crossbred (New Hampshire X Columbian) chicks. Both purified and semi-purified diets, varying in the concentration of protein, fat, crude fiber and energy were used. Three methods of feeding were used, namely: ad libitum feeding; equalized feed intake; and equalized nutrient intake. The results indicated that when chicks were fed isonitrogenous-isocaloric diets, the substitution of fat calories for glucose calories resulted in improved weight gains and greater pro-

tein and energy utilization and protein retention. This was true for ad libitum feeding as well as when nutrient intake was equalized for all experimental groups. Highly significant differences in growth were noted even though the calorie/protein ratios were constant. The best overall performance was obtained when the fat contributed between 20 and 38% of the total metabolizable energy of the diet. However, the beneficial effect of fat on both weight gain and protein retention was pronounced even at the highest fat level. At this point the fat contributed 57% of the total metabolizable energy and up to 97% of the non-protein calories of the diet, indicating that the chick's tolerance for fat, per se, is essentially unlimited. The beneficial effect of fat was apparent at all levels of protein, but it was most pronounced at the highest protein level. (Biological Abstracts)

REED, A. and **J. G. VELU.**
COMPARATIVE EFFECT OF A NORMAL AND HIGH-PROTEIN RATION WITH AND WITHOUT "AUROFAC" UPON GROWTH RATE OF CHICKS. *Indian J. Vet. Sci.*, 1957, *27*, 139-144. [Dept. Animal Husb., Allahabad Agric. Inst.]—Chicks received for 7 weeks basal rations containing 34 or 58 per cent. groundnut cake, with 23 or 32 per cent. total protein, respectively, each with or without Aurofac supplying 9 g. aureomycin and 9 mg. vitamin B_{12} per ton feed. In trials with both Rhode Island and White Leghorn birds, significantly better growth was obtained on the high-protein basal ration. Addition of Aurofac to both basal diets increased growth, though on the high-protein diet the increase was only during the first 4 weeks of age. (Nutrition Abstracts and Reviews)

SCHOLTYSSEK, S. Untersuchungen uber die Auswirkung von Kukenalleinfutter in verschiedenen Zustandsformen (I Presslinge. II Mehl. III gemahlene presslinge).
THE VALUE OF ALL-MASH RATIONS FOR CHICKENS IN DIFFERENT FORMS (I PELLETS, II MEAL, III GROUND PELLETS. *Ztschr. Tierphysiol. Tierernährung Futtermittelk.*, 1958, *13*, 230-237. [Inst. Tierzucht., Landwirtschaft. Hochsch., Stuttgart-Hohenheim.] English summary.—Six groups of day-old White Leghorn chicks were given for 8 weeks a standard commercial all-mash ration in one of 3 forms: pellets, meal or ground pellets, supplied by 2 factories. Individual weights and feed consumption were estimated weekly, and daily feed consumption and faeces were estimated on 3 consecutive days in the 3rd, 5th and 7th weeks. Weight gains for the 3 forms of ration were 756.5, 714.5, 665.6 and 713.5, 733.1, 730.4 g. for the pellets, mash and ground pellets from the 2 factories, respectively. Feed consumption was 1876, 1808, 1724 and 1944, 1994, 1905 g. and feed required 2.48, 2.53, 2.59 and 2.72, 2.72, 2.61 g. feed per g. weight gain. The contents of moisture, ash, crude protein, crude fat, crude fibre and N-free extracts in the 6 rations are tabulated. Only minor differences were found in coefficients of digestibility between the 3 forms and it was concluded that pelleting does not influence digestibility. It was concluded that different methods of manufacture and use of raw materials seem to affect feed efficiency more than the form in which the ration is given. (Nutrition Abstracts and Reviews)

SCHWARTZ, H. G., M. W. TAYLOR, and **H. FISHER.**
THE EFFECT OF DIETARY ENERGY CONCENTRATION AND AGE ON THE LYSINE REQUIREMENT OF GROWING CHICKS. *J. Nutrition*, 1958, *65*, 25-37. [Dept. Agric. Biochem., Rutgers Univ., New Brunswick, N. J.]—After 12 days on a commercial ration chickens were given diets composed mainly of maize, sesame meal and different ratios of cellulose and fat, supplemented with graded levels of lysine for 11 weeks. Control groups received 1.2 per cent. lysine. In 2 experiments the lysine supplement was progressively reduced during the test period. It was found that up to 4 weeks of age the chickens required 1.1 per cent. lysine in diets containing 20 per cent. protein and supplying 975 Cal. per lb. It was then necessary to decrease the

lysine, at the rate of 0.05 per cent. per week, to 0.08 per cent. at 8 weeks of age, since excess lysine caused an imbalance that depressed growth. Further reduction of lysine did not give optimum growth from 8 to 11 weeks. The requirement of lysine was found to be 1.13, 1.24 and 1.33 per cent. in diets containing 815, 965, and 1115 Cal. per lb., respectively, an increase of 0.07 per cent. lysine with each increase of 100 Cal.; the relation was linear within this range if the proportions of all other dietary components remained constant. Growth was improved by adding energy to the diet if sufficient lysine was available. An increase of 3 per cent. in the protein content of the diet raised the requirements of lysine by 0.1 per cent. on each energy level. (Nutrition Abstracts and Reviews)

SHUTZE, J. V., P. A. THORNTON, and R. E. MORENG. (Colorado State U., Fort Collins.)
PROTEIN ENERGY RELATIONSHIPS AS AFFECTED BY SEX AND MANAGEMENT. Poultry Sci. 37(5): 1063-1070. 1958.—The influence of different energy levels (ranging from 700 to 1000 productive calories per pound of feed) on growth and feed efficiency of broiler chicks was tested at 2 different protein levels. Other factors considered were the sex of the animal as well as management. Under battery reared conditions male growth and feed efficiency to 4 weeks of age were improved by both increased protein and energy. At 8 weeks of age improved growth due to energy increases was no longer evident. The higher level of protein was effective at all energy levels particularly in the low energy ration. Female growth was not affected by increased energy at the 20% protein level. When the protein level was increased to 24%, a growth depression occurred at the lowest energy level. This depression was corrected by increasing the energy level to 800 calories with no further improvement beyond this energy level. Under floor management conditions male growth was improved by increased energy at both protein levels, particularly so at 24%. Female growth was helped by increasing energy levels but not by the higher protein level. In general, feed efficiency for both sexes was improved as energy levels increased. From these data it is suggested that the protein requirement for the male bird to 8 weeks of age was greater than 20% while the female was not. (Biological Abstracts)

SQUIBB, ROBERT L. (Rutgers U., New Brunswick, N.J.), **J. EDGAR BRAHAM,** and **GUILLERMO ARROYAVE.**
RATE OF VITAMIN A ABSORPTION IN NEW HAMPSHIRE LAYING HENS SUBJECTED TO 20° AND 36° C. TEMPERATURES. Poultry Sci. 37(4): 932-934. 1958.—A group, of 5 birds, was kept in a natural environment having an average temperature of 20° C, and a 2nd group was kept in an environmental chamber at 36° C. After 48 hours of acclimatization, the serum of each bird was analyzed for total carotenoids and vitamin A. Ten thousand International Units of water miscible vitamin A was administered orally and the rate of absorption determined by analyzing the serum at 12, 24 and 48-hour intervals. There was no statistical difference between groups in rate of absorption of vitamin A. Hens do not appear to be as sensitive as rats to moderate increases in environmental temperatures. (Biological Abstracts)

TANGL, H., and **J. BOGRE.**
EXPERIMENT TO INCREASE THE WEIGHT OF GOOSE-LIVER BY SYNTESTRIN. (Libamáj növelési kisérlet Syntestrinnel.) Allattenvésztés, Budapest, 1958. 1. pp. 79-84.—In two experimental sets 44 geese were fattened by cramming and the authors conducted investigations to ascertain the effect of Syntestrin on the weight gain of the animals, and on the growth and quality of their liver. Syntestrin was introduced in various forms: in injections, in tablets applied subcutaneously, and in pills supplied with their feed. Syntestrin given in a single injection of 25 mg at the beginning of cramming proved en-

tirely uneffective. 20 mg of Syntestrin in tablets, applied subcutaneously at the beginning of fattening slightly influenced the food utilization of the animals and the weight of their liver as well. When the Syntestrin quantity in the tablets placed under the skin was increased to 60 milligrams, fattening results showed a considerable improvement The weight gain of an average experimental animal was 0.5 kg more, its food utilization higher by 2.8 starch percentage and its liver heavier by 80 g (25,07 per cent) in comparison with the average of the control group. A continuous feeding of daily 2 mg of Syntestrin during five weeks had only a very slight effect. (Hungarian Agricultural Review)

TARVER, FRED R. JR., and **J. CLYDE DRIGGERS.** (U. Florida, Gainesville.)
THE USE OF PEANUT OIL MEAL AND FISH MEAL-FISH SOLUBLES BLEND IN THE DIETS OF BROILERS. 2. THE EFFECT UPON PROCESSING YIELDS, FLESHING, PIGMENTATION AND FAT SCORES. Poultry Sci. 37(5): 1112-1116. 1958.—Individual processing yields and comparative fleshing, pigmentation and fat scores were criteria used to evaluate the influence of 6 different diets upon 704 straight-run White Plymouth Rock broilers. Two starter-grower battery studies (418 broilers) and one floor study (290 broilers) were terminated respectively at 60 and 66 days of age for slaughtering purposes. Processing yields and scores of broilers fed diets containing up to 50% peanut oil meal (55% protein) as a main source of protein were similar to broilers fed soybean oil meal as the main source of protein. Results would suggest the practical use of peanut oil meal (up to 50% as the major source of protein) in the diets of broilers when due consideration is given to the proper amino acid balance.—F. R. Tarver, Jr. (Biological Abstracts)

THOMAS, CHARLES H., E. W. GLAZENER, and **W. L. BLOW.**
THE RELATIONSHIP BETWEEN FEED CONVERSION AND ETHER EXTRACT OF BROILERS. Poultry Sci. 37(5): 1177-1179. 1958.—This study reports the differences observed in percent ether extract between (1) broilers of different sexes of the same strain and (2) between broilers of the same sex and strain with relatively good and poor feed conversion. In both sexes the relatively efficient group contained a lower percent ether extract than the relatively inefficient group. The males of both groups, however, had a lower percent ether extract than the 2 groups of females.—Authors. (Biological Abstracts)

THORNTON, P. A., and **R. E. MORENG.** (Colorado Agric. Expt. Sta., Fort Collins.)
THE STABILITY OF VITAMIN K_1 IN DEHYDRATED AND SUN CURED ALFALFA MEAL. Poultry Sci. 37(5): 1154-1159. 1958.—Stability of vitamin K_1 in dehydrated and sun cured alfalfa was determined using the chick biological assay method. Storage for 6 months in a dark room at 25° C appeared to have no effect on the vitamin K_1 level of dehydrated alfalfa meal. There did not seem to be any differences in alfalfa vitamin K_1 content in samples collected over a wide geographical area. Alfalfa meal from the 3rd cutting appeared to be slightly higher in this vitamin than the first cutting. Sun curing of this plant reduced its vitamin K_1 content by approximately 50%.—Authors. (Biological Abstracts)

THORNTON, P. A., and **R. E. MORENG.** (Colorado State U., Fort Collins.)
EGG PRODUCTION AND REPRODUCTION AS AFFECTED BY ARSANILIC ACID AND PENICILLIN. Poultry Sci. 37(3): 554-557. 1958.—Two breeds of hens (Single Comb White Leghorn and Delaware) were given a basal breeding diet. Three similar groups were given this diet supplemented with procaine penicillin G alone, Pro Gen (20% arsanilic acid) alone and these 2 compounds combined. Observations included egg production, feed efficiency, fertility, hatch-

ability, mortality and body weight maintenance. Penicillin supplementation had no effect on any of these factors except body weight maintenance where a highly significant increase was shown. The arsanilic acid groups both alone and in combination with penicillin, showed an approximately 10% increase in egg production. Body weight was increased significantly, hatchability increased slightly, feed efficiency was improved while mortality of the hens did not appear to be affected. —P. A. Thornton. (Biological Abstracts)

TOMIYAMA, T., Y. YONE, Y. HARADA, Y. KATO, M. OKAMOTO, M. YAMAOKA, T. KOYANAGI, S. UCHIDA, G. KATO, Y. MURAKAMI, S. TANAKA, and **S. MATSUO.**

STUDIES ON UTILIZATION OF WASTES IN PROCESSING SHELLFISH. V. THE EFFECT OF VISCERA-EXTRACT OF ATRINA PECTINATA JAPONICA ON CHICK GROWTH AND EGG PRODUCTION. Bull. Japanese Soc. Sci. Fish. 22(6): 374-377. 1956.—The addition to 100 g of all-vegetable protein ration of a 2.8 g portion of the dried autolyzed viscera and a 0.3 g portion of an activated charcoal adsorbate, equivalent to 2.8 g of the dried autolyzate, resulted in a slight growth promotion of 35-day chicks during a 6-week feeding, as contrasted to a negative result obtained by addition of 1.35 g of a non-adsorbed fraction. The weight of anterior hypophysis and testis, and the length of humerus and femur increased in a linear proportion to the growth while the weight of thyroid gland was inversely proportional. One-year-old hens fed autolyzed viscera at a 2% dry weight basis for 100 days showed an egg production inferior to the control group. This is apparently due to delay of starting egg production in the experimental group, because when compared at the highest production period, a superior egg production in number as well as weight was observed in the experimental group. In 5 month old hens fed an all-vegetable protein ration for 3 months prior to the experiment, the supplementation of the autolyzate at a 2% dry weight basis gave a remarkable response in egg production.—Authors. (Biological Abstracts)

TUCKEY, RALPH, B. E. MARCH, and **J. BIELY.** (U. British Columbia, Vancouver, Canada.)

DIET AND THE RATE OF FOOD PASSAGE IN THE GROWING CHICK. Poultry Sci. 37(4): 786-792. 1958.—Fat supplements at levels up to 12% in the diet of growing chicks did not have a consistent effect on rate of passage of feed through the digestive tract. A diet containing 12% lactose passed through the digestive tract faster than a similar diet containing either sucrose or cerelose. The fiber content of the diet did not affect passage time when the fiber was adjusted with ground oat hulls or ground cellulose. Passage time was similar in chicks fed diets containing ground wheat or ground corn as the cereal component. The inclusion of chlortetracycline did not affect passage time with any of the diets tested. Rate of feed passage was retarded considerably if birds were excited during the determination of passage time.—J. C. Biely. (Biological Abstracts)

UBBELS, P. 1957. [State Inst. Poult. Breed., Beekbergen.] De invloed van het gebruik van stoffen met een hormoon- of vitamine-werking tijdens groei en produktie op de kwaliteit van slachtkuikens en eieren.

THE EFECT OF USING SUBSTANCES WITH A HORMONAL OR VITAMIN ACTION DURING GROWTH AND EGG PRODUCTION ON THE QUALITY OF TABLE BIRDS AND OF EGGS. *Voeding*, 18: 627-647. [B.] [English summary.] Reprinted in *Meded. Rijksinst. Pluimveeteelt* [*Beekbergen*], No. 68. A review. (Animal Breeding Abstracts)

VAN KOETSVELD, E. E. and **H. J. L. MAAS.** De calcium- en fosforgehalten van slachtkuikens onder invloed van extra vet in het rantsoen en/of hexoestrol-implantatie.

CALCIUM AND PHOSPHORUS CONTENT OF MARKET POULTRY AS AFFECTED BY EXTRA FAT IN THE DIET AND/OR IMPLANTATION OF HEXOESTROL. *Tijdschr. Diergeneesk.*, 1958, *83*, 600-607. [Inst. Mod. Veevoeding "De Schothorst", Hoogland.] English, French and German summaries.

Groups of North Holland Blue × Cornirock birds were given fattening feeds with crude protein (CP) 20 per cent., CP 20 and animal fat 5 per cent., CP 22½ and fat 5 per cent., or CP 25 and fat 5 per cent. After 6 weeks the CP content of each ration was reduced by 3 per cent. At 9 weeks half of each group were implanted with hexoestrol and all birds were killed at 11 weeks. Feed per kg. gain on the 4 rations was, to 9 weeks 2.86, 2.66, 2.53, 2.54 and to 11 weeks 3.11, 2.91, 2.82, 2.83 kg, respectively. Average weights at 9 weeks were 1128, 1125, 1240, 1256 g., and at 11 weeks for birds given hexoestrol 1627, 1620, 1778, 1766 g. and for those not given hexoestrol 1549, 1529, 1653, 1691 g. The average dressed carcase yield of implanted birds was slightly greater. The dressed carcases of birds given hexoestrol had P 8.8 to 10.1 and Ca 5.1 to 6.0 mg. per g. Corresponding values for birds not given hexoestrol were 9.8 to 11.5 and 6.0 to 6.6. There was no significant difference between sexes in this respect. The amount of fat in the ration had no significant effect on Ca and P metabolism. (Nutrition Abstracts and Reviews)

VOHRA, PRAN, and **F. H. KRATZER.** (U. California, Davis.)

THE EFFECTS OF LYSINE, BIOTIN, AND PANTOTHENIC ACID DEFICIENCIES ON THE PIGMENTATION OF TURKEY POULTS. Poultry Sci. 37(5): 1047-1050. 1958.— Deficiencies of biotin and pantothenic acid do not cause any depigmentation of the flight feathers of turkey poults and these vitamins are also ineffective in preventing the depigmentation caused by a lysine deficiency.—P. Vohra. (Biological Abstracts)

VONDELL, JOHN H. (U. Massachusetts, Amherst.)

DIAZINON—ITS EFFECT ON EGG QUALITY AND PRODUCTION. Poultry Sci. 37(4): 979-980. 1958.—Spraying 28 cc of Diazinon Maggot Control mixture (6000 ppm) daily on feed for 10 pullets failed to lower albumen quality. Feed consumption and egg production was lowered slightly in 10-day test. Giving normal feed, but requiring birds to drink 90 and 180 ppm. Diazinon in water also failed to change egg quality. Water consumption and egg production was lowered slightly with 90 ppm dosage and markedly with 180 ppm Diazinon in sole water supply.—J. H. Vondell. (Biological Abstracts)

WAIBEL, PAUL E. (U. Minnesota, St. Paul.)

EFFECTIVENESS OF UNKNOWN GROWTH FACTORS, ANTIBIOTIC, AND ANIMAL FAT IN TURKEY POULT RATIONS. Poultry Sci. 37(5): 1144-1149. 1958.—Early in the hatching season, unknown growth factors provided by 6% fish meal, 3% alfalfa meal, 3% distillers dried solubles and 2% dried whey produced only small growth increments with turkey poults when added to a corn-soybean oil meal diet. On the factorial addition of 3% grass juice and 50 ppm chlortetracycline·HCl to the supplemented diet, only chlortetracycline·HCl produced a response in growth. In an experiment conducted late in the hatching season wherein the unknown factors, grass juice, and chlortetracycline·HCl were added factorially to a corn-soybean oil meal basal turkey poult diet, each supplement produced highly significant and independent growth responses. Supplementation of "complete" poult diets with animal fat resulted in a marked growth response and improvement in feed efficiency, provided the protein level was adequate. —P. E. Waibel. (Biological Abstracts)

WAKELAM, J. A. and **W. P. JAFFE.**

GROWTH-PROMOTING FACTORS IN MALT DISTILLERS DRIED SOLUBLES. FIELD TRIALS AND PRELIMINARY FIND-

INGS. *Brit. J. Nutrition*, 1958, *12*, 147-158. [Distillers Company (Biochemicals), Ltd., Broadway House, The Broadway, Wimbledon, London.]

In field trials with turkey poults and with chickens killed as broilers at 13 weeks of age, dried solubles seemed to contribute some growth-promoting substance which was not provided by commercial whey and grassmeal. In laboratory experiments groups of 25 crossbred rations, presumably fully adequate, which contained fishmeal, yeast, chicks received for 4 weeks a basal semi-purified diet, containing casein 25, gelatine 15, maize starch 29, sucrose 10, lard 10, distiller's dried grains 5 and minerals 6 per cent. All essential amino acids and known vitamins were present in amounts exceeding those recommended by the U.S. National Research Council. Modifications of this diet were tested in a trial of 8 × 2 randomised block design. Addition of 4 to 7 per cent. dried distiller's solubles to the diet gave a significant increase of growth. The maximum response was usually obtained with supplements of 2 to 3 per cent. Supplements of dried distiller's concentrates and acetone-butanol fermentation residues did not improve growth. In some experiments dried distiller's solubles alone did not influence growth, but when they were combined with penicillin the growth response was highly significant. It is suggested that the solubles may act partly through the intestinal flora. (Nutrition Abstracts and Reviews)

WHARTON, F. D. Jr., J. C. FRITZ, (Dawe's Lab., Inc., Chicago) and **R. B. SCHOENE.**

THE EFFECT OF AN ORAL DOSE OF VITAMINS AND ANTIBIOTIC GIVEN DAY-OLD CHICKS AND POULTS ON GROWTH AND VIABILITY. Poultry Sci. 37(4): 939-944. 1958.—Only in the presence of unusual and unexplained mortality in control chicks was growth and viability improved when chicks were given an oral dose of vitamins and procaine penicillin at the hatchery and subsequently reared in batteries to 4 weeks of age. Poults similarly treated received no apparent benefit. Combining the vitamin-Penicillin preparation with methylcellulose consistently depressed growth of poults and increased variability. The latter effect was statistically significant.—Authors. (Biological Abstracts)

WISMAN, E. L., C. E. HOLMES, and R. W. ENGEL. (Virginia Agric. Expt. Sta., Blacksburg.)

UTILIZATION OF POULTRY BY-PRODUCTS IN POULTRY RATIONS. Poultry Sci. 37(4): 834-838. 1958.—Laboratory analysis of hydrolyzed feather meal, poultry by-products meal and poultry blood meal showed nutrient compositions favorable to fish meal and meat scrap. Experiments involving battery-reared chicks, floor broilers and laying hens indicated that performance was not affected when these protein concentrates were used to replace up to approximately one-sixth of the crude protein of commercial-type diets. Results with suboptimal crude protein diets showed that the poultry by-product concentrates were lower in protein quality than fish meal but were comparable to meat scrap and soybean oil meal.—E. L. Wisman. (Biological Abstracts)

WORDEN, A. N.

THE POTENTIATION OF LIVEWEIGHT GAIN IN CHICKS BY PIPERAZINE DIACETATE. *Lab. Practice*, 1958, 7, 461. [Nutrit. Res. Unit, Huntingdon.]

Three groups of 20 chicks were given a basal ration without or with piperazine diacetate 40 or 200 p.p.m. There was no significant effect on bodyweight gain or feed conversion in chicks from hatching to 28 days of age, but from 40 to 70 days of age weight gains were 657, 741, 763 g. and feed per lb. gain was 3.31, 2.92, 2.81 lb. for the 3 groups, respectively. Feeding trials over 200 days with rats and chicks produced no toxic effects when up to 200 p.p.m. piperazine diacetate was added to the ration.—(Nutrition Abstracts and Reviews)

WORDEN, A. N.
THE FEEDING OF FRESH AND STORED CHICK MASHES CONTAINING COD-LIVER OIL. *J. Agric. Sci.*, 1958, 50, 340-343. [Nutrit. Res. Unit, Huntingdon.]

With cross heavy-breed male chickens, comparisons were made between basal diets and diets which had been supplemented with stabilised cod liver oil or one of 2 levels of a powder of synthetic vitamins A and D. Each diet was offered fresh or up to 3½ months after mixing. Chicks on the supplemented diets grew better than those on the basal diets. Those which had cod liver oil had higher feed conversion ratios and slightly lower liver storage of vitamin A than those which had synthetic vitamins. Storage after mixing had no effect on the nutritive value of the diets. (Nutrition Abstracts and Reviews)

YOUNG, R. J., H. M. EDWARDS, Jr., and **M. B. GILLIS.** (Internatl. Minerals and Chem. Corp., Skokie, Illinois.)
STUDIES ON ZINC IN POULTRY NUTRITION. 2. ZINC REQUIREMENT AND DEFICIENCY SYMPTOMS OF CHICKS. Poultry Sci. 37(5): 1100-1107. Illus. 1958.—Experiments were conducted to determine the chicks' requirements for zinc under carefully controlled conditions where precautions were taken to isolate the chick from any environmental zinc. Chicks were housed either in plastic cages or in an epoxy resin-coated Petersime brooder. They were fed and watered in either glass or stainless steel containers. All chicks received glass-distilled water. Results show that chicks fed a diet for 10 days which analyzes to contain 15 ppm zinc, require not more than 40 ppm of additional zinc (total 55 ppm zinc) for maximum growth and for maximum length-to-width ratio of the leg bones. Chicks fed the basal diet for 3 weeks require not more than 40 ppm of supplemental zinc (total of 55 ppm zinc) for maximum growth. Not more than 55 ppm zinc for the prevention of enlarged hocks, for maximum length-to-width ratio of the leg bones and for good feathering in the 3-week-old chicks. Addition of 10 ppm of zinc to the diet gave maximum bone ash values in both the 10-day and 21-day-old chicks. The various symptoms of a zinc deficiency observed in the 21-day-old chicks are described and illustrated.—M. B. Gillis. (Biological Abstracts)

POULTRY PRODUCTS AND MARKETING

BANDEMER, SELMA L., ROBERT JOHN EVANS, and **J. A. DAVIDSON.** (Michigan State U., East Lansing.)
THE VITAMIN A CONTENT OF FRESH AND STORED SHELL EGGS. Poultry Sci. 37(3): 538-543. 1958.—Fresh shell eggs on the average contain 57.1 μg of vitamin A per egg, or 3.52 μg per yolk. Eggs held in cold storage for 12 months lost about 10% of the vitamin A, with most of the loss occurring between the 4th and 8th months. Concentration of vitamin A in the yolk decreased 20% during 12 months storage, due in part to the increased size of the yolk during the storage period. The loss of vitamin A on storage results from some change in the egg, such as the development of rancidity of the oil present in the yolk. On extended storage, eggs with clean and dirty shells lost the same amount of vitamin A.—S. L. Bandemer. (Biological Abstracts)

FRYE, GRACE R., H. H. WEISER, and **A. R. WINTER.** (Ohio State U., Columbus.)
INFLUENCE OF ANTIBIOTIC FEEDING ON THE KEEPING QUALITY AND ANTIBIOTIC CONTENT OF POULTRY PRODUCTS. Poultry Sci. 37(3): 633-637. 1958.—Chlortetracycline fed at a high level (1000 ppm) in laying rations could be detected in the eggs while oxytetracycline, penicillin, bacitracin and streptomycin fed

at the same level could not. Keeping time of eggs produced by high level antibiotic fed hens was no longer than that of the controls receiving no antibiotic. The keeping time of liquid egg to which 5 ppm of each of the antibiotics studied was added was no greater than that of the control. The liver, dark meat and light meat from chlortetracycline, oxytetracycline and bacitracin fed hens contained amounts of the antibiotics. It was highest in the liver and lowest in the white meat. Cooking destroyed the antibiotic. Long periods of chlortetracycline feeding did not appreciably extend the keeping time of the meat.—Authors. (Biological Abstracts)

FUNK, E. M., GLENN FRONING, ROBERT GROTTS, JAMES FORWARD, and **OWEN COTTERILL.** (U. Missouri Coll., Columbia.)
SEASONAL VARIATION IN EGG QUALITY. Res. Bull Missouri Agric. Expt. Sta. 659. 1-24. 1958.—The quality of albumen, as measured by Haugh Units, declined throughout the 1st test year (1954-55) but this decline was not as constant in 1955-57. The height of thick albumen tended to decline during the first 6 or 7 months of production and then remain about the same. The percentage of AA grade eggs as measured by Haugh Units declined from 98% in October to 17% in September but even in September 100% of the eggs were grade A or better when laid. The pH of the albumen of fresh laid eggs was constant at about 9.2 throughout the year. Shell thickness tended to decline from fall until summer (hot weather) and then remain about the same during the next laying year. This investigation indicated a higher incidence of meat and blood spots during the spring with a low incidence during the summer.—E. M. FUNK. (Biological Abstracts)

FUNK, E. M., GLENN FRONING, ROBERT GROTTS, JAMES FORWARD, and **QUINTON KINDER.** (U. Missouri, Columbia.)
QUALITY OF EGGS LAID BY CAGED LAYERS. Missouri. Agric. Expt. Sta. Res. Bull. 658. 1-8. 1958.—Layers (chickens) in cages produced fewer but larger eggs than their sisters on the floor. Eggs laid by birds kept in cages had slightly thicker shells and somewhat better albumen quality (Haugh Units) than eggs laid by birds on the floor but these differences were not statistically significant. Eggs laid by birds in cages contained more meat and blood spots than eggs laid by their sisters housed on the floor.—E. M. FUNK. (Biological Abstracts)

HELBACKA, N. V., G. D. QUIGLEY, and **C. S. SHAFFNER.** (U. Maryland, College Park.)
THE EFFECT OF MALATHION ON EGG QUALITY. Poultry Sci. 37(3): 728-729. 1958.—When O-O dimethyl dithiophosphate of diethyl mercoptosuccinate (Malathion) was added to litter carefully at the rate of 0.5 pounds per 20 square feet it did not affect albumen quality (Haugh Units), egg shell thickness, or egg weight, for an 18-day period following treatment. Egg production likewise, was not affected. When eggs were stored for 2, 10, 15, and 20 days, the insecticide did not significantly affect albumen quality or yolk mottling as observed on the broken-out eggs.—N. V. Helbacka. (Biological Abstracts)

HELBACKA, N. V. L. and **MILO H. SWANSON.** (U. Minnesota, St. Paul.)
STUDIES ON BLOOD AND MEAT SPOTS IN THE HEN'S EGG. 1. THE FLUORESCENT PROPERTY OF MEAT SPOTS. Poultry Sci. 37(4): 869-876. Illus. 1958.—Colored meat spots exhibited a fluorescent property when exposed to UV light whereas blood spots and degenerated blood did not possess this quality. Highly significant positive correlations existed between egg shell color and meat spot color, meat spot color and meat spot fluorescence, and egg shell color and meat spot fluorescence. Spots similar to meat spots in eggs were found in the oviducts of autopsied hens. Although these spots were found throughout the oviduct, they were concentrated largely in the

uterus. The close relationship between shell color and meat spot color and their fluorescent property strongly suggests that the pigments responsible in each case are similar both in kind and origin.—M. H. Swanson. (Biological Abstracts)

HELBACKA, N. V. L., and **MILO H. SWANSON.** (U. Minnesota, St. Paul.) STUDIES OF BLOOD AND MEAT SPOTS IN THE HEN'S EGG. 2. SOME CHEMICAL AND HISTOLOGICAL CHARACTERISTICS OF BLOOD AND MEAT SPOTS. Poultry Sci. 37(4): 877-885. Illus. 1958.—The pigment of colored meat spots responsible for their fluorescent property was identified as being largely protoporphyrin. This is in variance with previous reports suggesting that the color of meat spots is associated with their hematin content. Fluorescent meat spots were also found to be generally high in calcium. Red blood cells were not a normal constituent of these inclusions. It was concluded on the basis of these experiments that the majority of meat spots of shell eggs do not have their origin in degenerated blood.—M. H. Swanson. (Biological Abstracts)

MARION, WILLIAM W. (Purdue U., Lafayette, Indiana), and **WILLIAM J. STADELMAN.**
EFFECT OF VARIOUS FREEZING METHODS ON QUALITY OF POULTRY MEAT. Food Technol. 12 (7): 367-369. 1958.—Chicken fryers, fowl, turkey fryers and mature turkey toms were frozen by 4 different methods including liquid, plate, and moving air. The subsequent quality of meat was evaluated by the above mentioned physical measurements. Method of freezing exerted no significant effect on any of the measured quality criteria. However, in the case of chicken fryers a significant difference was found between tenderness of the right and left pectoralis major muscles. In the color survey a larger number of individuals selected one of the 2 darkest turkeys as 1st, choice. There was greater rejection of the lighter colored turkeys except for the whitest one which was one of the most frequently selected. Its very white color suggested to some individuals additional "cleanliness" or "sanitation". (Biological Abstracts)

SHERWOOD, D. H. (General Mills, Inc., Larro Res. Farm, Indianola, Iowa.)
FACTORS AFFECTING EGG QUALITY—A REVIEW. Poultry Sci. 37(4): 924-932. 1958.—This review article discusses a number of factors affecting egg quality. Defects discussed include albumen defects, yolk defects, shell color, egg size, and meat and blood spots. It is pointed out that there are a number of possible causes for most defects, and that there is no complete agreement between authorities on the causes of certain defects. Nearly 70 references are cited. (Biological Abstracts)

STADELMAN, W. J. (Purdue U., Lafayette, Ind.), and **M. L. WILSON.**
AN OIL DISPENSING AEROSOL FOR QUALITY PRESERVATION OF SHELL EGGS. Poultry Sci. 37(3): 731-733. 1958.—A series of studies were conducted comparing different methods of applying oil to the surface of shell eggs relative to their efficiency in maintaining albumen quality and preventing weight loss. Storage conditions were room temperature and refrigerated egg room at 55°F. Methods compared were dipping and spraying procedures which led to development of an aerosol applicator for shell treating eggs. Observations made on several methods for oiling with regards to oil shine, ease of application, and quality protection indicate the use of oil with a silicone present in small quantities dispensed from an aerosol container gave satisfactory results. (Biological Abstracts)

SULLIVAN, T. W., F. L. CHERMS, and **M. L. SUNDE.** (U. Wisconsin, Madison.)
GIBLET YIELDS AND DRESSED WEIGHTS OF FOUR CLASSES OF POULTRY. Poultry Sci. 37(3): 736-738. 1958.—The

average live weights, eviscerated weights, and dressing percentages are presented for broilers, roasters, stewing hens and Broadbreasted Bronze turkey toms. Giblet yields, neck yields and back yields are also presented as percentages of live weight and eviscerated weight. (Biological Abstracts)

MANAGEMENT

BECKER, WALTER A. and **GORDON E. BEARSE.** (State Coll. Washington, West. Washington Exptl. Sta., Puyallup.)

PRE-INCUBATION WARMING AND HATCHABILITY OF CHICKEN EGGS. Poultry Sci. (37)4: 944-948. 1958.—Chicken eggs from White Rock X Synthetic Dominant White and White Leghorn matings were subjected to various pre-incubation warming procedures. Their embryonic mortality and hatchability were compared with eggs kept in a 50°F. cooler. Warming the eggs for 5 hours at 100°F, one hour at 100°F, or leaving them overnight in a 70-73°F room before placing them in a room 50°F cooler improved their hatchability. The lower the hatchability of the eggs owing to length of storage or type of mating, when continuously held in a 50°F cooler, the greater was the increase in hatchability when the eggs were warmed. (Biological Abstracts)

FARMING IN SOUTH AFRICA. 1958.

EFFECT OF NOISE ON POULTRY. *Fmg S. Afr.*, 34,(3): 53.—In an 8-wk. experiment at Onderstepoort involving 400 test fowls and 900 controls it was found that incubation, fertility, hatchability and life span were not affected by passing trains. A sudden jarring noise was found to disturb fowls, but it had no effect when repeated regularly. (Animal Breeding Abstracts)

GUASCO, G. 1958. [Ist. Zootec. Gen., Univ. Stud., Milan.] Alternanza di illuminazione nell'allevamento del broiler.

INTERMITTENT ILLUMINATION IN BROILER BREEDING. *Zootec. e Vet., 13*, 169-178.—Day-old New Hampshire×Leghorn chicks. 35 in number were submitted to cycles of 1½ hrs. artificial light (30 watts) followed by 2½ hrs. of darkness. A similar number of controls were subjected to cycles of 15 hrs. light and 9 hrs. darkness. Live weight at the end of 70 days averaged 1117.5 g. in the experimental birds *v.* 1089.1 g. in the controls. Food consumption was less in experimental than in control birds. (Animal Breeding Abstracts)

HAYS, F. A. (U. Massachusetts, Amherst.)

LAYING HOUSE TEMPERATURE AND EGG PRODUCTION. Poultry Sci. 37(3): 592-595. 1958.—Egg production of pullets during the laying years 1955-56 and 1956-57 was examined for reaction to low house temperatures during the winter period. Three pure strains of Rhode Island Reds bred for high fecundity were included and records on reciprocal crosses between strains were also examined. In general, the egg production of all stocks declined in December, January and February. During January 1957 when the monthly mean house temperature fell to 34 degrees, egg production declined about 50% over that of the preceding November. All pure strains and reciprocal crosses reacted in a similar manner. Our data appear to support the idea that house temperatures should be maintained above 40 degrees in winter to make satisfactory egg production possible. (Biological Abstracts)

McCLUSKEY, W. H. (Oregon Agric. Expt. Sta., Corvallis), and **L. E. JOHNSON.**

THE EFFECT OF WATER SPACE UPON CHICK PERFORMANCE. Poultry Sci. 37(3): 729-730. 1958.—Comparison of water space allowances for chicks, varying from .2 to .96 inch per chick indicates no consistent differences in performance between groups on the space treatments used. Watering equipment appeared to give better results when located in the central part of the pen as compared to a location along the wall. (Biological Abstracts)

McCLUSKEY, W. M., and **L. E. JOHNSON.** (Oregon State Coll. Corvallis.) THE INFLUENCE OF FEEDER SPACE UPON CHICK GROWTH. Poultry Sci. 37(4): 889-892. 1958.—Five feeder space trials including 5387 chicks of 4 different breeds using 3 different types of feeders were conducted. There were 28 experimental groups which ranged from 130 to 350 chicks each. Feeder space allowances studied ranged from 0.5 to 3 inches per chick. Both White Leghorn and New Hampshire chicks grew as well on 1 inch of feeder space as similar pens allowed 2 or 3 inches when fed with metal trough type feeders. When hanging tube type feeders were used with White Rock chicks, pens allowed 0.5 inch of feeder space per chick performed as well as pens allowed 1 or 1.5 inches. Similar pens fed with troughs reached slightly heavier body weights than pens with tube feeders. Crosbred broiler stock fed with a mechanical chain type feeder performed as well on 0.5 inch of feeder space as similar pens receiving 1, 1.5 and 2 inches per chick. Performances indices were computed for 3 trials fed with individual feeders and groups allowed the smallest amount of feeder space in each trial were as good as groups allowed larger amounts of feeder space. Chick mortality was not associated with feeder space allowances in any consistent manner. (Biological Abstracts)

SACCHI, R. 1957. [Ist. Zoocolt., Univ. Perugia.] Sviluppo ponderale dei pulcini in regime forzato.

GROWTH IN CHICKS UNDER INTENSIVE MANAGEMENT. *Ric. sci., 27:* 3395-3429. [French, English and German summaries.]—The effect on growth, during the first 10 wks., of breed, sex, nutrition, housing and date of hatch was studied in chicks of White Leghorn, New Hampshire and White Rock breeds. A total of 20 groups, each comprising 40-51 birds, was made up so as to represent different combinations of the variables concerned, housing being either in batteries or cages [*pulcinaie*], and date of hatch varying from March to July. The highest av. live weight at 70 days (1328 g.) was recorded in a group of N.H. ♂♂, hatched in July and cage-reared on a balanced feed without the addition of antibiotics. W.L. ♀♀, hatched in June and battery-reared on a feed supplemented with aureomycin, averaged only 490 g. at 68 days. (Animal Breeding Abstracts)

SARAZA [ORTIZ], R., J. GARCIA FREIRE, and **V. LLAMAZARES.** 1957. [Fac. Vet., Leon.] Contribucion al estudio de la produccion del pollo "broiler".

SOME ASPECTS OF BROILER PRODUCTION. *An. Bromatol., 9:* 447-454. [English summary.]—Average live weight at 8 wks. of age of 10 White Leghorn×Rhode Island Red birds was 764 g. *v.* 728 g. for 10 White Leghorn purebreds. The quality of the meat of the crossbreds was superior to that of the purebreds. (Animal Breeding Abstracts)

STADELMAN, WILLIAM J. (State Coll. Washington, Pullman.) OBSERVATIONS WITH GROWING CHICKENS ON THE EFFECTS OF SOUNDS OF VARYING INTENSITIES. Poultry Sci. 37(4): 776-779. 1958.—Broiler type chickens were subjected to sound levels varying from 65 to 115 decibels. These sounds were reproductions of aircraft fly-over noises so as to eliminate side effects due to shadow or other conditions present with regular aircraft flying overhead. Broiler chickens were grown without loss or weight differences when subjected to sounds of approximately 115 decibels in the 20 to 10 thousand cycles per second range with maximum intensity in the 150 to 1200 cycles per second range. From observations made in this study it is apparent that loss in a pen of broiler chickens is much more likely to occur from an isolated low level flyover than continuous noises resulting from close proximity to an airfield. Sound alone applied from day-old to market-age had no measurable effect on chickens. (Biological Abstracts)

WALKER, D. M., and **E. C. OFFORD.** 1958. [Roy. Vet. Coll., London.]
QUALITY TESTS ON HEN EGGS PRODUCED IN LAYING BATTERIES AND IN FOLD UNITS. *J. agric. Sci., 51:* 72-77.—Two groups of Rhode Island Red×Light Sussex pullets were housed in batteries and in a fold unit resp. Samples of the eggs produced were collected monthly during a 9-mth. period and weights of egg fractions, the quality of yolk and thick albumen, and porosity coefficients were determined. There were no consistent differences between the 2 groups except with regard to the colour of the volk, which was lighter in battery-housed birds. (Animal Breeding Abstracts)

WILSON, W. O., and **A. E. WOODARD.** (U. California, Davis.)
EGG PRODUCTION OF CHICKENS KEPT IN DARKNESS. Poultry Sci. 37(5): 1054-1057. 1958.—White Leghorn hens kept in continuous darkness for 5 weeks continued to lay eggs. Some hens did cease egg production, while others, previously pausing, started to lay again. Hens that paused for no longer than 5 days, laid at a rate of 60.2 and 77.1% in the 2 tests. The decline in egg production was greatest in the hens losing the largest percentage of body weight. (Biological Abstracts)

YOUNG, R. G., T. H. COLEMAN, and **J. A. DAVIDSON.** 1958. [Dep. Poult. Husb., Michigan State Univ., East Lansing.]
THE EFFECT OF WASHING EGGS ON HATCHABILITY. *Quart. Bull. Mich. agric. Exp. Sta., 40:* 754-757.—About 1618 eggs from a breeding flock of S.C. White Leghorns were divided into 5 approx. equal lots, 2 of which were washed by different methods at 110° F. and 1 dry cleaned; the controls comprised 1 lot that was clean when gathered and 1 that was dirty. Hatchability was best in the washed lots, but the only statistically significant difference was between one of the washed lots and the clean lot.

Of 452 Broad Breasted Bronze turkey eggs, 152 were incubated without treatment and the remainder were divided between 2 washing methods. There was no significant difference in hatchability between any of the 3 lots. (Animal Breeding Abstracts)

GENERAL

ATKINSON, J. C., K. R. BENNETT, and **E. W. CALLENBACH.** (Pennsylvania State U., State College.)
EFFECTS OF CERTAIN ENVIRONMENTAL FACTORS AND SEX ON POULT GROWTH WITH REFERENCE TO FUTURE EXPERIMENTAL DESIGN. Poultry Sci. 37(5): 1051-1054. 1958.—Effects of battery, deck, section, variety, level of crowding, and sex on growth of poults reared in batteries were evaluated. Large error variations associated with section to section differences were noted. These were measured by higher-order interactions which were highly significant in terms of bird to bird variation. It is suggested that in such experiments statistical information is limited by the number of sections or pens and that information could be increased much more rapidly by increasing numbers of sections than by increasing birds per section. (Biological Abstracts)

BATEN, W. D., and **E. W. HENDERSON.** (Michigan State U., East Lansing.)
METHODS OF WEIGHING HATCHING DATA IN STATISTICAL ANALYSIS. Poultry Sci. 37(4): 781-785. 1958.—Five different statistical procedures for estimating significance were applied to the hatching records of 92 hens mated alternately to males of their own and other breeds (cross-mated). There was no significant difference in hatching power of the resultant embryos sired by either class of

males (pure vs. cross) by any of the 5 methods of computation. These findings confirmed a previous report in which the Chi square was used. (Biological Abstracts)

BOLLEN, A. G., A. A. McARDLE, and R. H. MORRIS.
AN INVESTIGATION OF THE COMMERCIAL POULTRY INDUSTRY OF THE UNITED STATES OF AMERICA-1956. World's Poultry Sci. Jour. 14(2): 137-140. 1958.—A summary of a full report prepared for the Australian government. (Biological Abstracts)

HUNTER, WILLIAM L. (California Dept. Agric., Sacramento.)
HOW CALIFORNIA SOLVED THE DRUG LAW PROBLEM. Western Feed and Seed 13(3): 27, 61-63. 1958.—New disease remedies such as antibiotics for livestock and poultry sold at retail and in medicated feeds are now controlled in California for human and livestock safety by requiring registration and licensing of dealers and proper labeling. (Biological Abstracts)

MANN, AMAR SINGH.
THE POULTRY INDUSTRY IN PUNJAB, INDIA - ITS PAST, PRESENT AND FUTURE. World's Poultry Sci. Jour. 14(2): 141-145. Illus. 1958.—Native chickens, the Desi, a descendent from the wild Himalayan fowl, and the Aseel, a broad breasted fighting breed have a variety of colors, but the Desi retains the shape of the jungle fowl *Gallus bankiva*. Commercial poultry farms were opened during World War II and the state has a research farm and demonstration farms. Spirochaetosis (tick fever) is common and ticks are controlled by benzene hexachloride. (Biological Abstracts)

MICHEL, JUAN MANUEL.
GROWTH OF THE POULTRY FEED INDUSTRY IN MEXICO. World's Poultry Sci. Jour. 14(2): 131-132. Illus. 1958.—The industry which is 8 years old has developed chiefly the last 3 years. Monthly production is 30,000 tons. Much feed is home mixed. (Biological Abstracts)

STILES, P. G., R. K. RINGER, and L. F. WOLTERINK. (Michigan State U., East Lansing.)
A PROCEDURE FOR LABELING BLOODSPOTS IN CHICKEN EGGS WITH RADIOACTIVE PHOSPHORUS. Poultry Sci. 37(3): 600-601. 1958.—Bloodspots in chicken eggs can be labeled with radioactive phosphorus (P^{32}) by injecting P^{32} labeled red blood cells intravenously into a hen. Bloodspots formed after the labeled cells have been injected show detectable radioactivity if the spots contain more than 0.024 ml blood. This procedure may be used to determine when bloodspots are formed and blood volume within a hen or a bloodspot. With the hens tested it was found that bloodspots were formed within the period 9 hours prior to ovulation to 3.5 hours after ovulation. (Biological Abstracts)

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Australian Turkey Federation, 89 Quay Street, Sidney, N.S.W.
Egg and Egg Pulp Marketing Board, 528-530 Collins Street, Melbourne, C. I., Victoria
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Poultry Farmer's Association of Western Australia, 44 St. George's Terrace, Perth
Poultry Farmers Co-op, Society Ltd., Box 743K, G. P. O. Brisbane, Queensland
Poultrymen & Farmers' Trading Co. Pty. Ltd., 286 Queensberry Street, N. Melbourne, Victoria
Producers Co-Operative Ltd., Carlingford, N.S.W.
Red Comb Association, Inc., 272 Gouger Street, Adelaide, South Australia
Roche Products Pty. Ltd., 1 Barrack Street, Sydney, N.S.W.
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beginning on a theoretical and sometimes conjectural level. A gradually increasing dosage of empirical observations is then given in their support. Many terms are defined in a special sense or carry an intentionally vague meaning. Statistical descriptions of different aspects of the subject are segregated in inserts, called boxes (some containing lists of literature), which do not form an integral part of the text. They may be taken or left alone according to the reader's inclination. But most of the statistics used are homespun and therefore need not hold terror for any biologist. Standard errors and tests of significance are not given, because nearly all the data cited are used to illustrate ideas and not to adduce proof of precise quantitative relations. In short, the biological phenomenon of selection is approached without either the naturalist's disdain of or the mathematician's reverence for statistical formulation."

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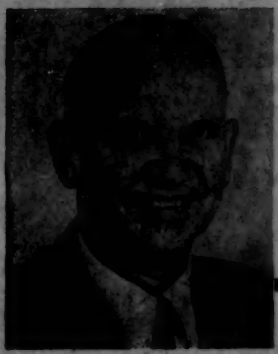
Now, turkey growers can give their birds the most effective protection against blackhead and also get new profit benefits. New Histostat-50 contains a proven active ingredient—4-nitrophenylarsonic acid—from the chemical family of arsenicals which are universally recognized for their growth-stimulating properties. And this new formulation permits this active ingredient to do its work more effectively and completely, especially as birds approach market age or maturity. Used at the rate of only one pound per ton of turkey mash, Histostat-50 prevents blackhead and promotes finer finish. Effective against blackhead in chickens, too. Write for technical information.

Because of the continuing need for good flock husbandry, Dr. Salsbury's current consumer advertisements carry this message: PROPER MEDICATION IS ONLY ONE PART OF GOOD FLOCK MANAGEMENT. FOR BEST RESULTS, PRACTICE SOUND FEEDING, HOUSING, SANITATION AND PEST CONTROL.

Dr. SALSBURY'S LABORATORIES
Charles City, Iowa

WORLDWIDE SERVICE TO THE POULTRY INDUSTRY



#2 IN THE SERIES OF *Questions and Answers About Granite Grit*

DR. G. F. HEUSER, Director
Stonemo Poultry Research Farm

Question: What are the main benefits of grit feeding that can easily and accurately be measured?

Dr. Heuser: The two main benefits are increased production (either weight or number of eggs) and feed efficiency. Increase in weight is especially important in broiler production.

Question: Are there any other important values of feeding grit?

Dr. Heuser: Yes, an insurance value. As already indicated, the gains usually are not large, but might be considerable under some situations or under stress. The feeding of grit might be of advantage to meet adverse conditions and act as insurance to counteract some of the factors which might be deficient and hence detrimental. The possible loss would be small (the cost of feeding the grit) but the gain might be considerable. In other words, there is little to lose, but there might be much to gain.

A leading poultry nutritionist has recently stated: "A couple of years ago we wondered about the need for grit in the case of broilers being fed all-mash or pelleted diets. However, we now believe that it is wise to feed grit to broilers and other classes of poultry even though they are on all-mash feeds. We have encountered several field cases where birds have become impacted with shavings and other litters, when no grit was fed. I believe that in some cases it might be possible to do a satisfactory job without grit in broilers and layers fed all-mash diets, but it seems to me since there is always a danger of the birds consuming litter, it is good insurance to have grit available."

Do you have a question regarding the feeding of granite grit? If you do, please address it to Dr. G. F. Heuser, c/o Stonemo Poultry Research Farm, Lithonia, Georgia.

STONE MOUNTAIN GRIT COMPANY, INC., Lithonia, Georgia

STONEMO GRANITE GRIT—*The Grit with the* **"EXTRA GRINDING SURFACES"**